Selected Portions of the United States Army Corp of Engineers Sign Standards Manual

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This document is available as publication EP 310-1-6A and EP 310-1-6B (two volumes) and is available at no cost. Contact the USACE via its web site (see section VI.B) to request these documents. Make sure to request all updates when ordering this document, as there have been several updates to the manual.

(Note: Numbers/letters in parentheses indicate the original section in the USACE manual)

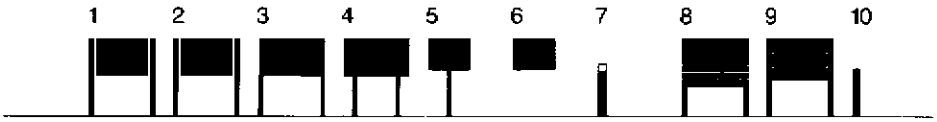
This section describes the material, fabrication and assembly requirements for all Corps signs shown in sections 5-18 of this manual.

General specifications, page B2-2a, provide standard material specifications, procedures, and manufacturers requirements relating to all sign types. The requirements specific to each sign type are grouped in sections: the first pages describe material and graphic requirements and the following pages refer to individual sign configurations, indicated with a specification code.

The alphanumeric code listed in the matrix for each different sign type indicates the material of which the sign is manufactured, graphic application as well as the method of assembly (singular post, double post, wall mounted, etc.). Therefore, each sign type may be applicable for more than one specification code; selection depends on size, environment and aesthetics.

The following specification codes are used: RRW for Routed Redwood signs, HDO for High Density Overlay Plywood signs, ALU for Aluminum signs, and SCP for Screenprinted signs. Not all installations are fabricated in every material; the diagram shown below indicates the correct application.

Material Specification Code



RRW	RRW-1	RRW-2				RRW-6	RRW-7			
HDO	HDO-1	HDO-2	HDO-3	HDO-4	HDO-5	HDO-6	HDO-7	HDO-8	HDO-9	
ALU				ALU-4	ALU-5	ALU-6				
SCP						SCP-6	SCP-7			SCP-10

1. Submittals

All contractors and products shall be approved in accordance with these specifications. Prior to the production of any work, the sign manufacturer shall submit a signed copy of fabrication shop drawings to the designated representative of the Corps of Engineers. These shall include finishes, graphic reproduction and hardware. All shop drawings signed "approved" shall supersede originating drawings. Manufacturers shall assume responsibility for errors in their drawings.

The following samples must be submitted which, once approved, shall become the standards against which the product shall be judged: joining detail, laminating detail, graphic application detail, hardware application, detail of each type of finish material and exact scaled pattern, showing typeface, letter-, word- and line-spacing, and placement of legend on sign panel.

2. Quality Assurance

The manufacturer, upon acceptance and approval of the submittal, assumes full responsibility for the construction, materials and workmanship of the work described in these specifications and drawings, and will be expected to comply with the spirit as well as the letter in which they were written.

The manufacturer shall replace or repair as directed by the designated representative of the Corps of Engineers all such damaged or defective materials which shall appear within a period of one (1) year from the date of final acceptance.

The manufacturer shall notify the designated representative of the Corps of Engineers of any discrepancies in, or omissions from drawings and specifications before commencing work and request clarification. A written addendum will be sent; the Corps of Engineers will not be responsible for oral instructions.

The manufacturer shall note that any cost caused by defective or ill-timed work, as a result of, but not limited to inferior workmanship or materials, improper scheduling or delinquent ordering shall be borne by the party responsible therefor.

3. Packaging

Each package shall include complete instructions to unpack, assemble and install the sign. Approved instructions shall be furnished by the manufacturer as well as a telephone number for information on sign assembly and installation.

Complete sign assemblies shall be shipped dis-assembled in two (2) units, unless otherwise instructed. One unit shall contain sign panel(s) and frame assembly(s), and one unit post(s) and assembly hardware.

Where panels are ordered separately, individual or groups of sign panels shall be shipped with all necessary hardware (in case of aluminum panels with frame(s)) in one unit. Packaging shall be adequate to provide maximum protection from damage during storage and shipping. Panel shall be protected on both sides with a face sheet, and post to be completely wrapped in cardboard and bound. Cautionary labels for correct shipping and handling shall be placed on each package.

All deliveries and shipping schedules shall be coordinated with the designated representative of the Corps of Engineers.

4. Materials

All sign fabrication shall comply to the standards as described in the Graphic Standards Manual. No modification of any kind shall be permitted without the express written confirmation by the Corps. All materials shall be new and of first quality. Factory seconds shall not be accepted.

Shop tolerances shall not exceed ±.0625", field tolerances shall not exceed ±.125".

Where the terms "approved equal", "other approved", "equal to", "acceptable", or other general qualifying terms are used, it shall be understood that reference is made to the ruling and judgement of the designated representative of the Corps of Engineers.

A list of approved and qualified products and materials is included in the back of this Section or can be obtained from the Corps of Engineers. No use of material other than those specified in this manual or "approved equal" shall be permitted.

5. Graphics

All typesetting shall comply to standards for the use of Helvetica Regular, Helvetica Medium, and Helvetica Bold, as described in Appendix D, of this manual.

Legends shall conform to the standards as outlined in Section 4, and as shown on the layout drawing for each specific sign panel. No modification shall be permitted. Horizontal and vertical alignment of legends shall not deviate ±.0625". Camera-ready full-size artwork of the Corps signature shall be provided by the Corps of Engineers, see page 4.4-9. No modifications shall be permitted.

All artwork shall be reproduced using first generation images, as provided in this manual. Reproduction shall be performed using a distortion-free photo-mechanical process or a digitizing system with a pointing accuracy of 1/100" (1/25mm) or better. Plotter systems shall have a resolution and positioning accuracy of 1/50mm or better.

All retro reflective graphics shall be produced in complete one-piece make up, not in individual sections. Lettering up to 45" high shall be produced prespaced in one piece. Larger lettering and graphics must be prepared prespaced in exact registration to abutting sections.

6. Engineering Criteria

The following criteria have been used as the standards governing material specification, assembly and footings for all recreation project signs, unless otherwise specified.

Wind Pressure	35 PSF
Soil	2-KSF-Minimum
Frost Depth	48" Maximum

If these criteria are not adequate for a specific sign location, necessary modification shall be made to conform to the basic assembly specifications of specified sign type. Modifications may include, but are not limited to thicker panels, larger dimension sign posts or larger footing configuration.

The design of the structural requirements of special one-of-a-kind signs shall conform to the basic assembly specifications for similar sign types. The modified assembly shall fulfill the requirements of local criteria for wind pressure, soil and frost depth.

Assembly configurations and material specifications are referenced under "specification code" with sign descriptions in Sections 5-18. Detailed material, assembly, and mounting specifications are provided on the next pages.

The following materials shall be used for the construction of signs unless special panels and/or modifications require more stringent standards of performance:

Sign posts with nominal dimension 4" x 4" shall use construction heart Redwood per grading rules of the California Redwood Association, or better. For nominal dimensions larger than 4" x 4", treated Douglas Fir No.1 or better, Southern Yellow Pine No.1 or better shall be used unless otherwise specified. Material shall be well-seasoned and free of any defects. All post sizes may be up to but no less than .5" than nominal dimensions, and will be sanded smooth prior to finishing.

Sign panels shall use HDO plywood, .75" thick unless otherwise instructed, or Redwood, clear heart, 2" thick.

Footing shall consist of concrete 2500 PSI (28 days). Dimensions shall be as indicated on page B.2b.

6. Engineering Criteria (Cont'd)

The required footing size and depth as specified in the two right columns of the diagram below, will depend on the criteria listed in the aforementioned columns. Use the diagram to select the appropriate footing configuration. Any conditions that go beyond the criteria shown below shall be engineered on a site-by-site basis.

Footing Diagram

Post Size	Frost Depth	Post Number	HAGL	Panel Size (sq. ft.)	Panel Height	Footing Cross Section	Footing Depth
4" x 4", 4" x 6", 6" x 6"	0" - 30"	1	42"	≤9	≤4' - 6"	1' - 6"	2' - 6"
					>4' - 6"	1' - 6"	4' - 0"
				>9	na	1' - 6"	4' - 0"
			60"	≤7	≤3' - 6"	1' - 6"	2' - 6"
					>3' - 6"	1' - 6"	4' - 0"
				>7	na	1' - 6"	4' - 0"
		2	42"	≤20	≤5' - 0"	1' - 6"	2' - 6"
					>5' - 0"	1' - 6"	4' - 0"
				>20	na	1' - 6"	4' - 0"
			60"	≤16	≤4' - 0"	1' - 6"	2' - 6"
					>4' - 0"	1' - 6"	4' - 0"
				>16	na	1' - 6"	4' - 0"
4" x 4", 4" x 6", 6" x 6"	30" - 36"	1	42"	≤10	≤5' - 0"	1' - 6"	3' - 0"
					>5' - 0"	1' - 6"	4' - 0"
				>10	na	1' - 6"	4' - 0"
			60"	≤9	≤4' - 6"	1' - 6"	3' - 0"
					>4' - 6"	1' - 6"	4' - 0"
				>9	na	1' - 6"	4' - 0"
		2	42"	≤24	≤6' - 0"	1' - 6"	3' - 0"
					>6' - 0"	1' - 6"	4' - 0"
				>24	na	1' - 6"	4' - 0"
			60"	≤20	≤5' - 0"	1' - 6"	3' - 0"
					>5' - 0"	1' - 6"	4' - 0"
				>20	na	1' - 6"	4' - 0"
4" x 4", 4" x 6", 6" x 6"	36" - 48"	1,2	na	na	na	1' - 6"	4' - 0"
6" x 8", 9" x 9"	0" - 48"	1,2,3	na	na	na	2' - 0"	4' - 0"

1.1 Signs

1. Materials

Panels shall be constructed of clear heart, kiln-dried Redwood throughout, one board thick (2" gross) using 2" dimensional lumber (2" x 6", 2" x 8", 2" x 10"). Surfaces shall be edge-glued and planed smooth to finish out 1.75" thick. The end grain of laminated panel ends shall be face-glued with a 2" x 1.25" end strip, reinforced with 2" zinc plated No.14 Phillips pan-head screws counter sunk and filled with glued-in redwood plugs.

Frames shall be constructed of construction heart Redwood lumber. Dimension length of frame 2" longer than finished panel, to create a 1" reveal. Lumber sizes vary depending on post dimensions.

Post Size	Lumber
4" x 6"	2" x 4"
6" x 8"	4" x 4"
9" x 8"	4" x 4"

Intermediate support members shall be installed for large size panels.

Panel Size	Support Member(s)
0'-0" to 5'-11"	0
6'-0" to 11'-11"	1
12'-0" to 17'-11"	2
18'-0" and up	3

Solid post shall be fabricated of one piece construction heart Redwood per grading rules of the California Redwood Association, or better. Material shall be well-seasoned and free of any defects. All post sizes may be up to but no less than .5" than nominal dimensions, and will be sanded smooth prior to finishing.

Glue-laminated post can be used as an alternate and shall be constructed of clear heart, kiln-dried Redwood only.

All complete sign panel and post assemblies must be pre-drilled and assembled in the shop prior to shipment to check alignment and ensure proper fit once installed. Panels manufactured as separate units shall be pre-drilled with hardware inserted in place.

All complete sign panel and post assemblies must be pre-drilled and assembled in the shop prior to shipment to check alignment and ensure proper fit once installed. Panels manufactured as separate units shall be pre-drilled with hardware inserted in place.

1.2 Hardware

Panel attachment hardware shall be
– 2" x 2" aluminum keyhole receiving plate, to be attached to panel with four (4) No.12 flat head wood screws. A slot of .5" deep shall be routed to receive hex bolt.
– .375" lag bolt with .5625" hex head and .5625" hex nut. Bolt shall be threaded through frame leaving .125" of shaft exposed on either side after attaching hex nut. Panel with keyholes is hung on hex head or nut. Four (4) keyholes shall be used per panel for dimensions up to 8'-0". Larger panels must use six (6) plates per panel.

Frame assembly hardware shall be 2" x 2" or 3" x 3" aluminum angle bracket, to be attached to frame with six (6) .375" lag bolts.

Frame attachment hardware shall be .5" x 6" lag bolts to attach frame to sign posts.

1.3 Laminates

Adhesive shall be phenolic resornicol moisture resistant, or approved equal. Application must be performed within 15 minutes between the first glue application and the final setting of the clamps. The surface of each joint face shall be completely covered with adhesive. Glued panels to cure for a minimum of 24 hours with clamps in place.

Air temperature shall be between 70-90 degrees Fahrenheit during drying of boards, glue application and curing process. Boards to be stacked on drying racks and dried not less than 24 hours prior to gluing.

Frame assembly hardware shall be 2" x 2" or 3" x 3" aluminum angle bracket, to be attached to frame with six (6) .375" lag bolts, or approved equal.

Frame attachment hardware shall be .5" x 6" lag bolts to attach frame to sign posts.

1.4 Finishes

Primer shall be ready-mixed exterior alkyd (oilbase), Sherwin Williams, Benjamin Moore, Pittsburgh Paint, or approved equal. Routed areas and raised surfaces of the Corps Castle Logo shall be brushed with one (1) coat of primer. To prevent bleeding on the face of the panel, Do Not use thinner to remove residual paint, but wipe clean with dry cloth. Remaining surface paint shall be removed with the final sanding of the sign face.

Paint shall be ready-mixed exterior alkyd gloss enamel, Sherwin Williams, Benjamin Moore, Pittsburgh Paint, or approved equal. Raised surfaces of the Corps Castle Logo shall be brushed with two (2) coats of Corps Communication Red. To prevent bleeding on the face of the panel, Do Not use thinner to remove residual paint, but wipe with dry cloth.

1.4 Finishes (Cont'd)

Reflective liquid shall be 3M White No. 7216, or approved equal. Brush apply a minimum of two (2) coats in routed areas to ensure a uniform finish. Follow manufacturer's specification for application and drying time. To prevent bleeding on the face of the panel, Do Not use thinner to remove residual liquid, but wipe clean with dry cloth. Remaining surface liquid shall be removed with the final sanding of the sign face.

Stain shall be semi-transparent waterproof, anti-bacterial redwood stain to match Corps Brown, Olympic brand redwood stain No. 715, or approved equal. Apply with brush or roller to all exposed surfaces of sign panel and posts. Do not stain areas to receive paint or areas already painted. Remove excess paint by wiping with dry cloth. Stain shall be thoroughly mixed prior to and during application to ensure even pigmentation. Panels will be rack dried a minimum of 24 hours and completely dry to the touch prior to shipping.

Clear water repellant finish shall be Woodlife, CWF brand, or approved equal. Apply to all non-exterior surfaces not treated with stain. Follow manufacturer's specification for application and drying time.

Paint room facilities shall be well-ventilated, dust-free and enclosed. Air temperature shall not be less than 65 degrees Fahrenheit during application of paint.

Finished sanding shall be performed after finish coats have been applied and thoroughly dried. Panel to be machine sanded, removing up to .0625" of the sign surface. No planing, use of hand-held belt, orbital or vibrating sander shall be permitted. All sawdust and sanding residue shall be removed from the sign.

2. Graphics

2.1 Routing

All artwork shall be machine routed unless otherwise specified (see Castle Logo) using a vertical-sided flat-bottom bit. Routed graphics must conform exactly to the same size artwork, including the Corps Castle Logo. Routing depth to be a uniform .375", except where such depth would distort very small forms. Corners of the castle logo and typography less than 3" cap height shall have a radius no greater than .0625". Typography of 3" and larger shall have radii no greater than .125". All burrs on edges will be removed by sanding with the grain of the wood.

Castle Logo may be machine routed or fabricated of cast acrylic for increased durability. Acrylic insert shall have the same placement, color and dimensions as a routed Castle Logo, and shall be mounted flush to the face of the sign panel. Acrylic insert shall be glued in to the routed slot with clear silicone adhesive.

Both routed and acrylic communication marks that are repeatedly defaced can be replaced. Routed Castle Logos shall be cut around the perimeter of the outside routed concentric circle and sent to original manufacturer for replacement insert. Insert shall be replaced with a cast acrylic resin molded replica backed with a redwood panel to screw logo to the back of the original sign panel. Seal cutline with clear silicone sealers after Logo is replaced. Acrylic Castle Logos can be replaced by removing the old plug and after thoroughly cleaning the routed slot inserting a new Castle Logo with clear silicone adhesive.

All items listed below shall conform to material specifications as described on page B.3-3a for routed Redwood signs, unless otherwise instructed on this page.

1 Panel, 2" thick with 2" x 1.25" endstrip. Dimensions of sign face indicate the panel including the endstrip.

2 Frame, 2" x 4" or 4" x 4" lumber. Length of frame to be sized 2" longer than panel to create a 1" reveal on either side.

3 Solid or glue laminated post, 4" x 6", 6" x 8", 9" x 8" or 12" x 12". The dimension parallel to the sign face shall be equal to the Capital Letter Height (A). Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

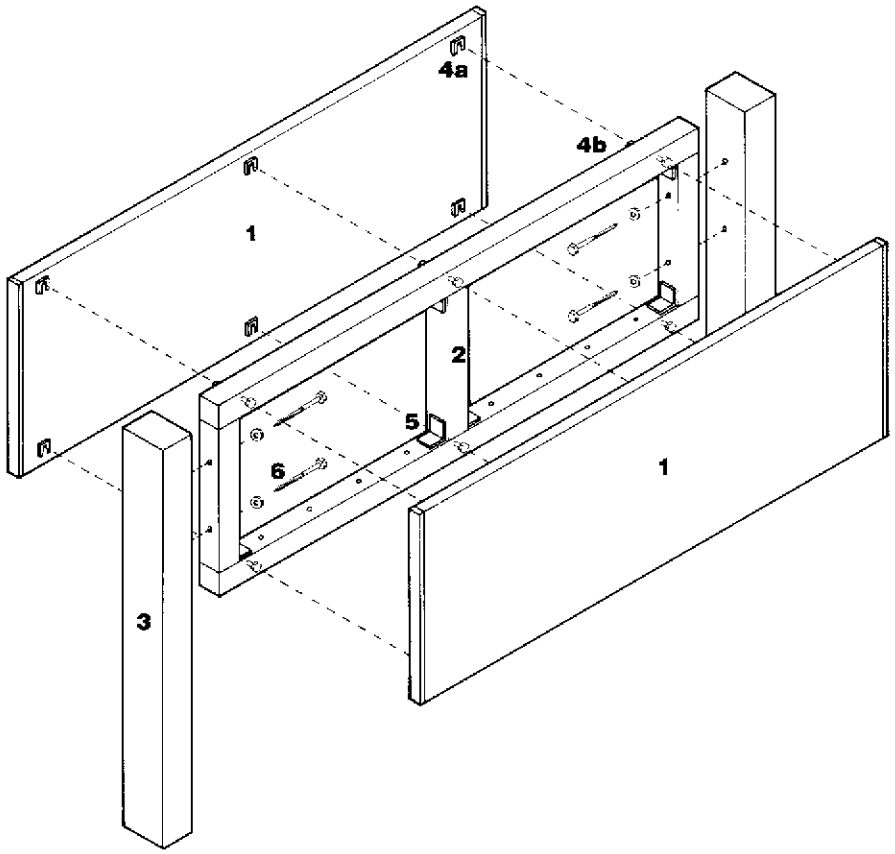
4a-b Panel attachment hardware. For attachment see detail 1, page B.7-1.

5 Frame assembly hardware. For attachment see detail 2, page B.7-1.

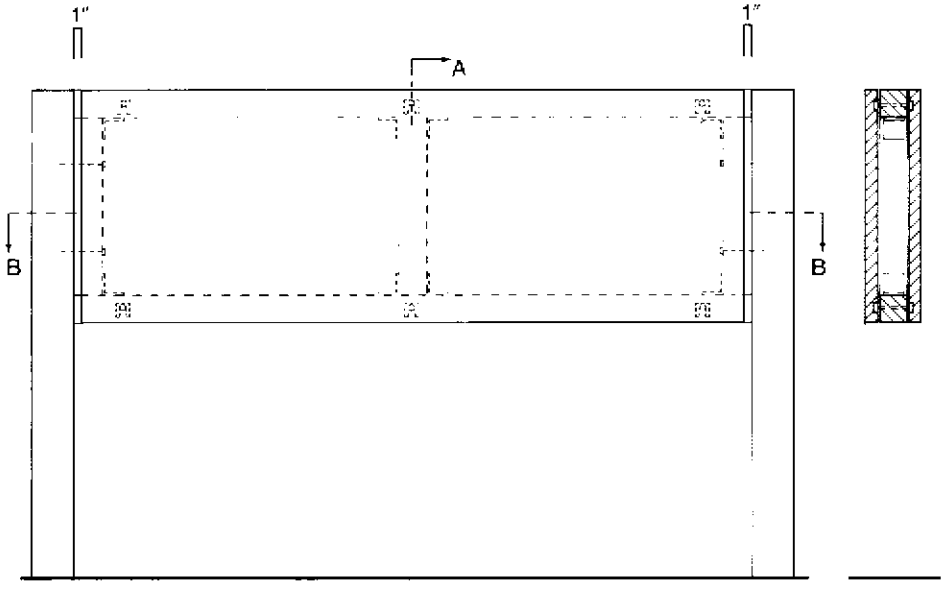
6 Frame attachment hardware.

NOTE: Intermediate support member(s) as shown are not representative for this particular sign type. Use depends on the length of each individual sign panel, see frame specification page B.3.

NOTE: Signs with 12" legend will be engineered on a one-of-a-kind basis to follow the design intent as shown in these specifications.



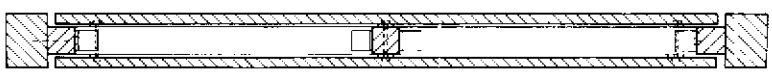
Exploded View



Front View

A

Cross Section A-A



Cross Section B-B

All items listed below shall conform to material specifications as described on page B.3-3a for routed Redwood signs, unless otherwise instructed on this page.

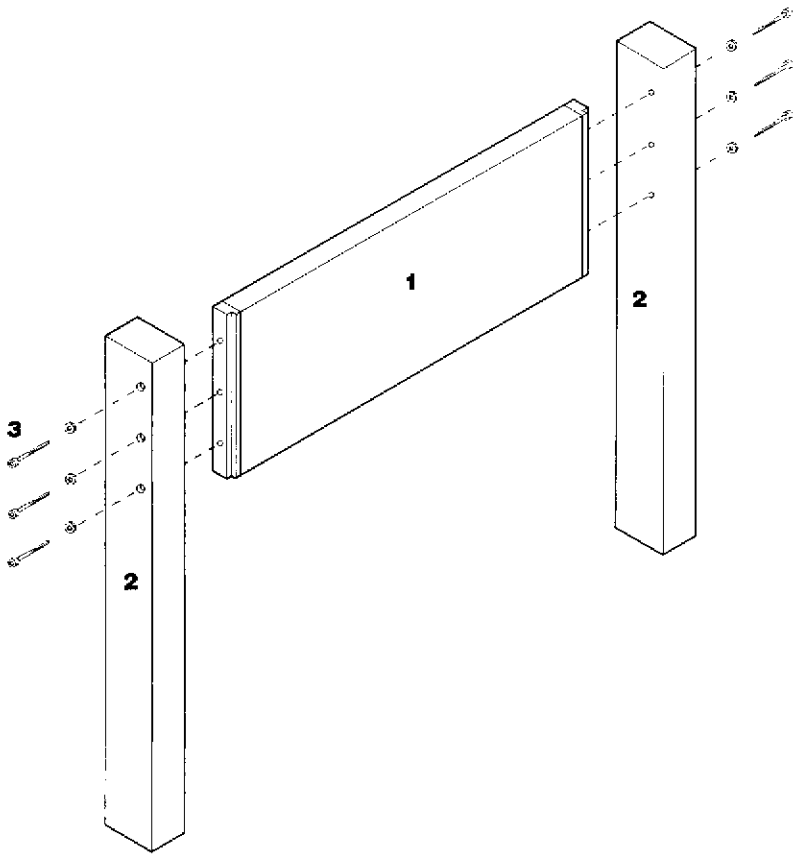
1 Panel, 2" thick with 2" x 1.25" routed endstrip to create a .5" reveal, see detail 3, page B.7-2. Width dimension of sign face is measured from the inside reveal on each endstrip.

2 Solid or glue laminated post, 4" x 6" or 6" x 6". The dimension parallel to the sign face shall be equal to the Capital Letter Height (A). Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

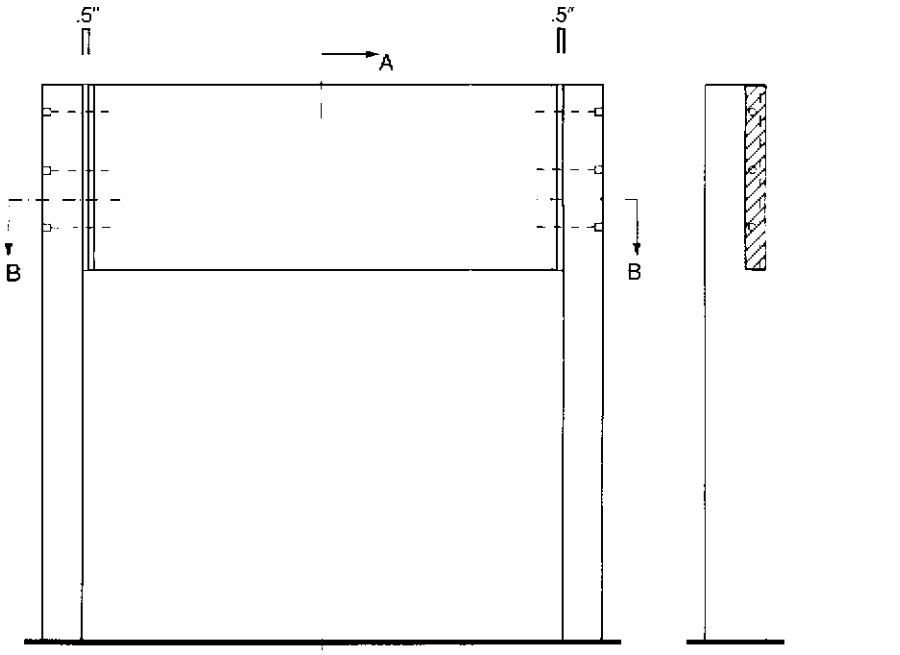
3 Panel attachment hardware shall be .3125" socket head cap screws and .5" washers, countersunk at least .25" from the surface of the sign post. For attachment see detail 3, page B.7-2.

NOTE: Double-faced signs shall be installed identical to single-faced signs, with a second sign panel mounted flush to the back of the sign post. For attachment see detail 4, page B.7-2.

NOTE: Signs with panel heights less than 27" shall require only 2 bolts per side.

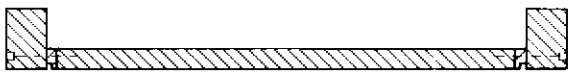


Exploded View



Front View

Cross Section A-A



Cross Section B-B

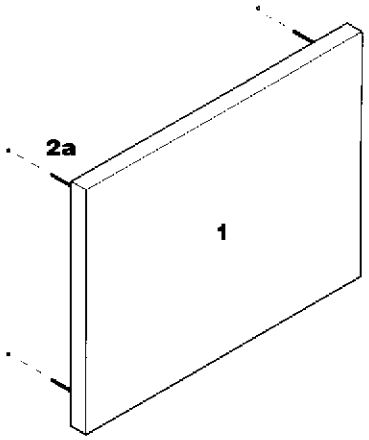
All items listed below shall conform to material specifications as described on page B.3-3a for routed Redwood signs, unless otherwise instructed on this page.

1 Panel, 2" thick with 2" x 1.25" endstrip. Dimensions of sign face indicate the panel including the endstrip.

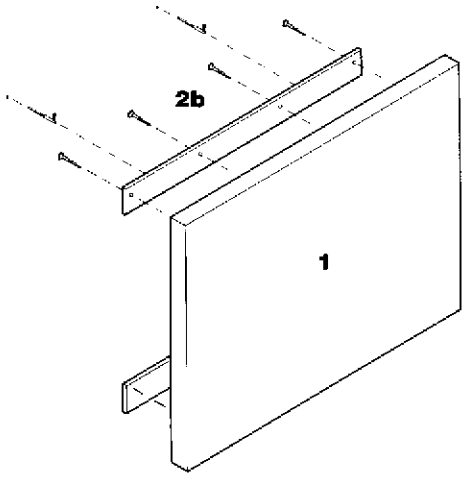
2a Panels no greater than 24" x 36" shall be attached to wall surfaces using threaded studs protruding from back of sign. Studs shall be permanently affixed square to the face of the panel.

Silicone adhesive shall be used in wall holes receiving the threaded studs, and in generous amount on the remainder of the sign back. Wall surface shall be clean and free of loose particles to promote good adhesion of silicone. Use foam tape or other temporary bracing until permanent adhesives are set.

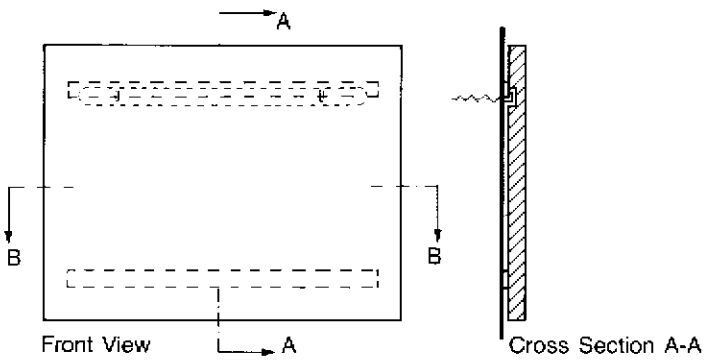
2b Panels greater than 24" x 36" shall be attached to wall surfaces using a metal cleat, receiving hardware in a routed slot. Metal cleat shall be .125" aluminum, 2" wide with length 8" less than width of sign. It shall be screwed securely to the back of the sign face with No.12 flat head Phillips zinc plated wood screws. Cleat is to overlap routed groove with sufficient clearance to receive wall hardware. Appropriate hardware for wall material shall be used to securely fasten the panel (i.e. lead anchors, hollow-wall anchors, lag bolts, etc.). Silicone adhesive may be used in addition to mechanical fasteners to permanently secure sign panel to wall surface.



Exploded View (2a)

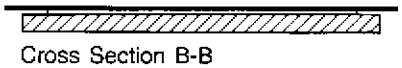


Exploded View (2b)



Front View

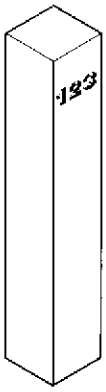
Cross Section A-A



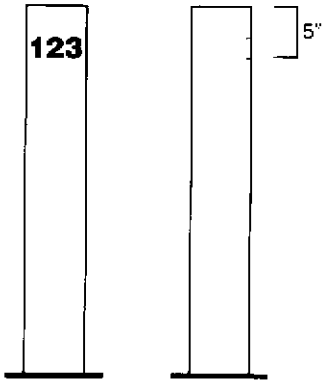
Cross Section B-B

All items listed below shall conform to material specifications as described on page B.3-3a for routed Redwood signs, unless otherwise instructed on this page.

1 Solid or glue laminated post, 6" x 6". Graphics shall be routed directly in the sign post, not in an individual panel. Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.



Isometric



Front View Side View

Plan

1. Materials

1.1 Sign

Panel shall be fabricated from HDO plywood, 60-60 non-oiled resin impregnated fiber, black in color. All Douglas Fir exterior marine-grade, to meet product standard PSI-83; or all exterior plywood PSI-83 group 1, with B grade veneers on both sides. Each panel should be edge-branded marine-grade HDO EXT PSI-83; or HDO B-B G I EXT PSI-83, 7 PLY.

Panel shall be .75" thick unless otherwise specified. Panel dimensions shall have a tolerance of ±.125". No cleats or joints shall be permitted for panels with a dimension smaller than or equal to 10'–5".

Panels shall have corners with a safety radius of .187" unless otherwise specified.

Edges shall be rounded or beveled to a radius of .09375".

All surfaces shall be flat and smooth. Core gaps to be filled with polyester body filler, Bondo, or approved equal. Finish-sand all edges and panel face. Back surface shall be sanded with 50-60 grit sand paper.

All drilling shall be done with high-speed drills, using solid backing to avoid chipping.

All cutting shall be done with high-speed saws. Rotary saw blades to be carbide tipped. Power saws shall have little or no set and as much lead as possible. Blades on table saws shall not extend more than 1", and not less than .5" through panel. Panels will be fed through slowly to avoid damage to overlay.

Panels to be stored shall be stacked flat on a clean surface in an enclosed and well-ventilated area; do not store on concrete surfaces.

Wood frame shall be constructed of construction heart Redwood lumber. Dimension length of frame 2" longer than finished panel, to create a reveal. Lumber sizes vary depending on post dimensions.

Post Size	Lumber
6"	2" x 4"
9"	4" x 4"
12"	4" x 4"

Intermediate support members shall be installed for large size panels.

Panel Size	Support Member(s)
0'–0" to 5'–11"	0
6'–0" to 11'–11"	1
12'–0" to 17'–11"	2
18'–0" and up	3

Metal frame shall be fabricated from Aluminum 6061-T6 "Z" bar, 3" x 2.6875" x 2.6875". Construction, attachment and placement is described on specific sign panel pages where reinforcement may be required.

Solid post shall be fabricated of one piece construction heart Redwood lumber, per grading rules of the California Redwood Association, or better. For dimensions larger than 4" x 4", treated Douglas Fir No.1 or better; Southern Yellow Pine No.1 or better shall be used. All post sizes shall be .5" less than nominal dimensions, and will be sanded smooth prior to finishing. All materials shall be well-seasoned and free of any defects. Douglas Fir and Yellow Pine shall be weathered a minimum of one (1) year after installation prior to stain application.

Glue-laminated post can be used as an alternate for dimensions 4" x 6" or larger and shall be constructed of clear heart, kiln-dried Redwood only.

All complete sign panel and post assemblies must be pre-drilled and assembled in the shop prior to shipment to check alignment and ensure proper fit once installed. Panels manufactured as separate units shall be pre-drilled with hardware inserted in place.

1.2 Hardware

Panel attachment to post or brace shall be 3/8" socket head cap screws, 3/8" washers and 4-prong straight barrel T-nuts. T-nut to be countersunk and back-filled with Bondo, or approved equal, flush to front of panel. Cap screw head to be countersunk a minimum of .25" below the surface of post.

Panel attachment to frame shall be
– 2" x 2" aluminum keyhole receiving plate, to be attached to panel with four (4) No.12 flat head wood screws. A slot of .5" deep shall be routed to receive hex bolt.
– .375" lag bolt with .5625" hex head and .5625" hex nut. Bolt shall be threaded through frame leaving .125" of shaft exposed on either side after attaching hex nut. Panel with keyholes is hung on hex head or nut. Four (4) keyholes shall be used per panel for dimensions up to 8'–0". Larger panels must use six (6) plates per panel.

Wood frame assembly hardware shall be 2" x 2" or 3" x 3" aluminum angle bracket, to be attached to frame with six (6) .375" lag bolts, or approved equal.

Wood frame attachment hardware shall be .5" x 6" lag bolts to attach frame to sign posts.

1.3 Laminates

Adhesive for post construction and duplex HDO panels shall be phenolic resornicol moisture resistant, or approved equal. Application must be performed within 15 minutes between the first glue application and the final setting of the clamps. The surface of each joint face shall be completely covered with adhesive.

Air temperature shall be between 70-90 degrees Fahrenheit during drying of boards, glue application and curing process. Lumber to be dried not less than 24 hours prior to gluing.

Moisture contents of lumber to be glued shall be between 12-15%, with a 3% margin between wettest and driest piece.

Surface joints shall be smooth and true, free from machine joining marks and chipped or loosened grain.

1.4 Finishes

Paint shall be Benjamin Moore No.120-60 poly-silicone enamel, or approved equal. Apply one (1) coat to the back and edge of the panel as a primer, prior to application of retro-reflective sheeting, and one (1) coat after application to seal the edge. Sheeting shall be masked before painting, and shall be removed immediately after enamel application. A minimum of 4=.25 mil. dry film thickness shall be applied (two generous coats). Front of panel where retro-reflective sheeting will be applied shall not be painted.

Stain shall be semi-transparent waterproof, anti-bacterial redwood stain to match Corps Brown, Olympic brand redwood stain No. 715, or approved equal. Apply with brush or roller to posts. Stain shall be thoroughly mixed prior to and during application to ensure even pigmentation. Posts will be dried a minimum of 24 hours prior to shipping.

Paint room facilities shall be well-ventilated, dust-free and enclosed. Air temperature shall not be less than 65 degrees Fahrenheit during application of paint.

Cleaning of the panels shall be performed prior to application of paint or retro-reflective sheeting, to remove parting agent on panel surface. Areas to be painted shall be scrubbed with petroleum hydrocarbon solvent, Toluene, Socal No. 1, or approved equal, using an abrasive synthetic fiber pad. Wipe the surface clean with mineral spirits.

Finished sanding shall be performed prior to the application of the first and second coat of paint. Paint must be thoroughly dried before sanding. All sanding residue shall be removed from the sign with tack cloth. Do not sand panel after applying the second coat of finish paint.

2. Graphics

2.1 Retro-reflective sheeting

Background and legend shall be engineer grade, premium quality, wide angularity enclosed lens retro-reflective material to meet or exceed the standards of:

– General Services Administration, Federal Supply Service specification *L-S-300-C, Reflectivity 1.*

– U.S. Department of Transporation, Federal Highway Administration, *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects.* current edition *FP-85 Sections 633.06* and *718.01.*

Background and legend shall use sheeting from the same manufacturer. Mixing of sheeting from different manufacturers shall not be permitted.

No more than twelve (12) months will have elapsed from date of purchase to the date of application.

Background application to HDO Plywood shall be as described by the manufacturer and approved by the designated representative of the Corps of Engineers. Corps Brown and all highway colors may be either pressure-sensitive or heat-activated applied. Special waterway colors are only available with pressure-sensitive adhesive.

Panels shall be covered with one unspliced sheet, unless the dimension is larger than 48″ in vertical direction. Splices shall be positioned so as not to fall within legends. Top piece shall overlap bottom piece by a minimum of .5″, but not more than .75″. Spliced sheets shall be color matched.

Background shall be adhered to front of sign panel prior to legend application.

Legend application shall be as described by the manufacturer and approved by the designated representative of the Corps of Engineers and may be either pressure-sensitive or heat-activated applied. No loose or curled edges, bubbles or blisters shall be permitted.

Legend shall be adhered to sign panel after application of background sheeting.

Top edge treatment shall be Avery No.961, 3M No.639 clear film 3" wide, or approved equal. Film shall be applied in 24" strips, beginning from each outside edge and taping toward center of sign. Film shall overlap at least 2" at each joint.

Heat-activated sheeting shall be double-cycled through the vacuum applicator, one time when applying the background sheeting and one time when applying the legend.

2.2 Silkscreen

Silkscreening shall only be applied to Traffic Signs, Prohibition Symbol Signs, Boundary Markers, Trail Markers and Fee Symbols. No application shall be permitted for signs with Corps Brown background or any Danger or Warning sign as shown in Sections 7, 8, 9, and 14 of this manual.

Formulation cards shall be filed for each individual ink color to ensure consistency of the product. Filed information shall include, but is not limited to, ink formula with designated color code, thinner and retarder adjustments in grammes, batch numbers of inks, thinner and retarder, mesh tension, emulsion coating and exposure units/time. When semi or fully automatic equipment is used, additional information shall be filed for: off contact, peel, speed, squeegee, flood speed, curing temperature and belt speed.

Inks shall have a light fastness rating of 7-8 on the din 16525 (Wool Scale) or equivalent industry standard, and must be able to withstand 375 degrees Fahrenheit (190 degrees Celsius) without noticeable change off pigmentation.

Ink type shall be acceptable to manufacturer of substrate.

Inks shall be formulated using a computer colorimetry system and shall be matched with a tolerance of ±0.1 grammes.

Colors shall conform to the listing in Section 4 in this manual.

Ink cure and compatibility are to be confirmed by cross hatch tape test, or equivalent industry standard.

Thinner and retarder used in the adjustment of the inks shall be specified by the ink manufacturer. Additions shall be made by weight with a tolerance of ±0.1 grammes and filed on the formulation card.

Screens shall be 254 polyester monofilament, mesh tensioned to no less than 18 newtons. Mesh tension, emulsion coating and exposure units/time are to be established and filed on the formulation card.

Printing shall be performed on semi or fully automatic equipment with a repeatability tolerance of ±.004" in conjunction with a forced air conveyor drier. Off contact, peel, speed, squeegee, flood speed, curing temperature and belt speed are to be established and filed on the formulation card.

A fiberglass laminated urethane squeegee set at a 75 degree angle is to be used.

All items listed below shall conform to material specifications as described on page B.4-4a for HDO plywood signs, unless otherwise instructed on this page.

1 Panel, .75" thick backed with 4" x .75" HDO strips glue laminated flush to the edge of the panel. Strips to be laminated prior to finish work.

2 Frame, 2" x 4" or 4" x 4" lumber. Length of frame to be sized 2" longer than panel to create a 1" reveal on either side.

3 Solid or glue laminated post, 4" x 6", 6" x 8", 9" x 8", or 12" x 12". The dimension parallel to the sign face shall be equal to the Capital Letter Height (A).

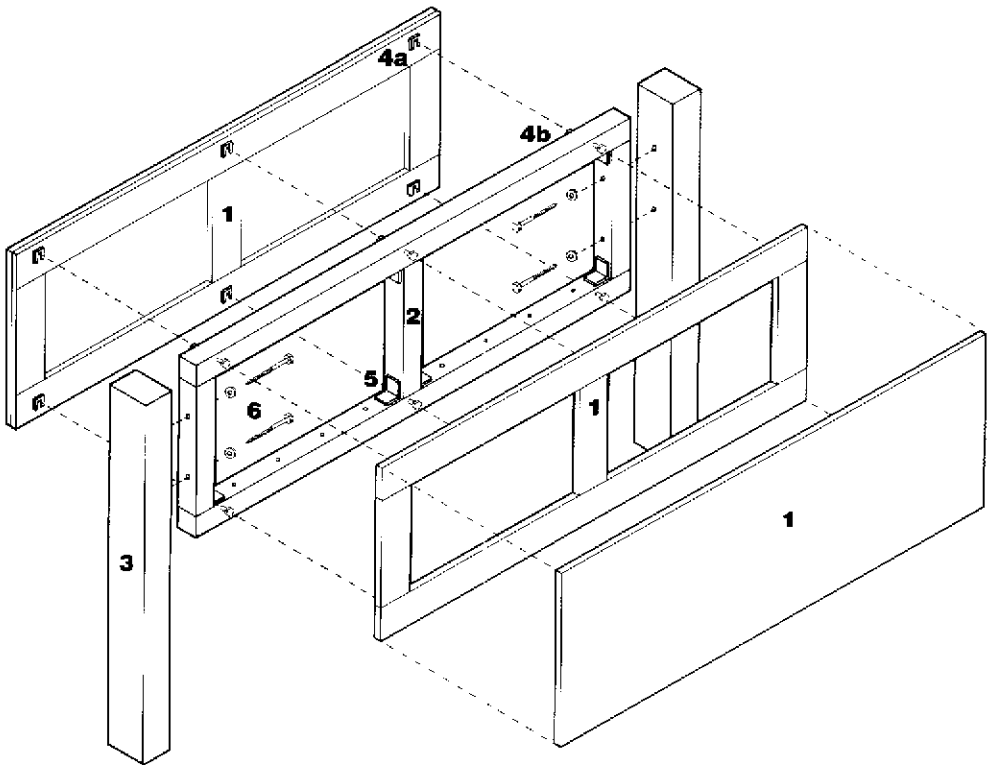
Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

4a-b Panel attachment hardware. For attachment see detail 1, page B.7-1.

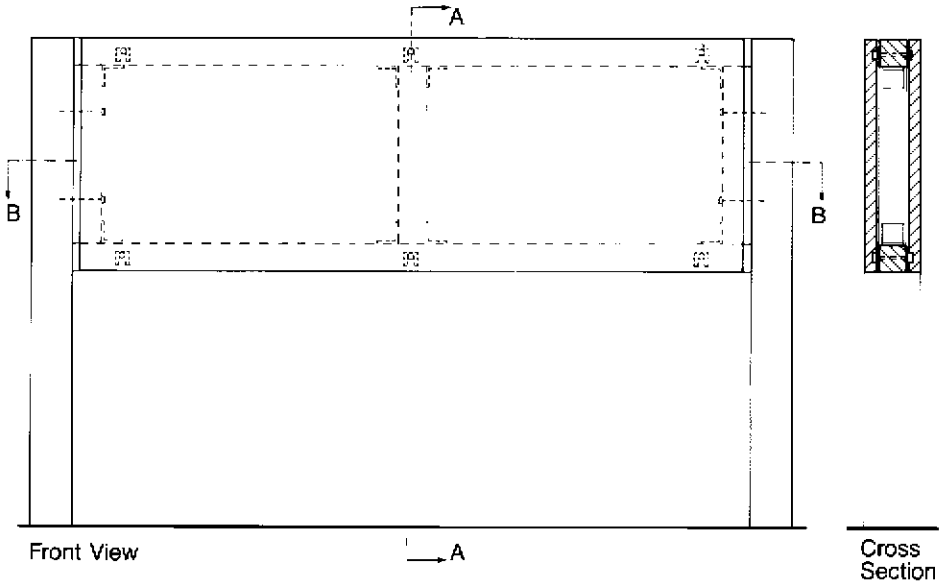
5 Frame assembly hardware. For attachment see detail 2, page B.7-1.

6 Frame attachment hardware.

NOTE: Intermediate support member(s) as shown are not representative for this particular sign type. Use depends on the length of each individual sign panel, see frame specification page B.4-4a.

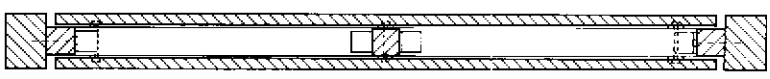


Exploded View



Front View

Cross Section A-A



Cross Section B-B

All items listed below shall conform to material specifications as described on page B.4 through B.4b for HDO plywood signs, unless otherwise instructed on this page.

1 Panel, .075" thick backed with 4"x 0.75" HDO strips, glue laminated flush to the edge of the panel, Strips to be laminated prior to finish work.

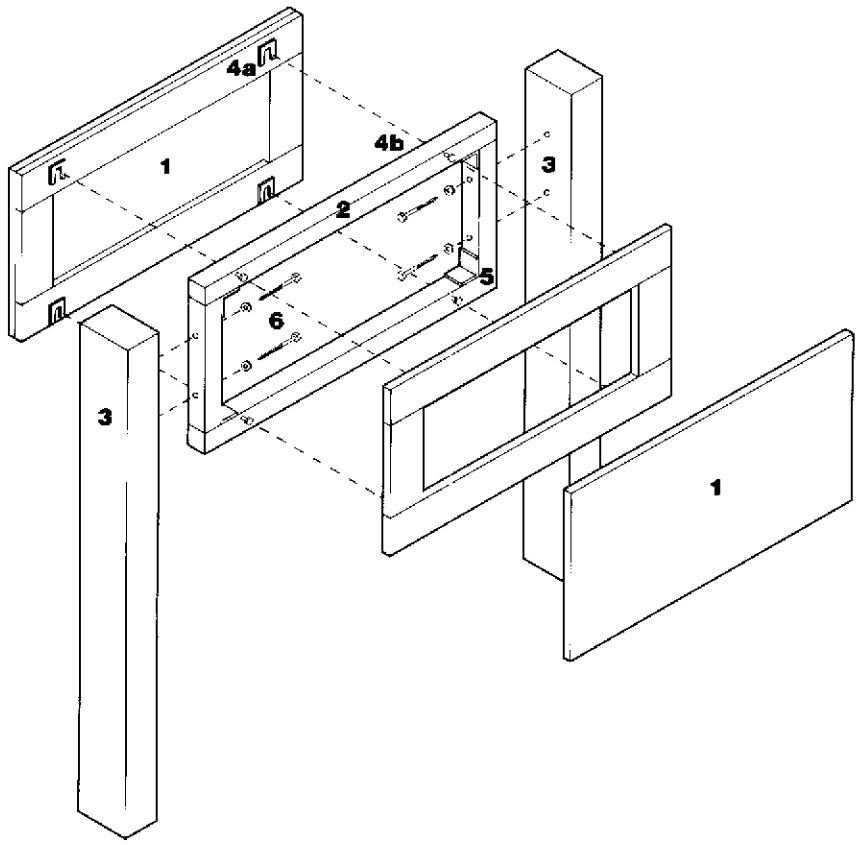
2 Frame, 2" x 4" (4" nominal dimension facing back of sign panel) or 4" x 4" lumber. Length of frame to be sized 1" longer than panel to create a 0.5" reveal on both sides of the panel.

3 Solid or glue laminated post, 4" x 4", 4" x 6", or 6" x 6". The dimension parallel to the sign face shall be equal to the Capital Letter Height (A). Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

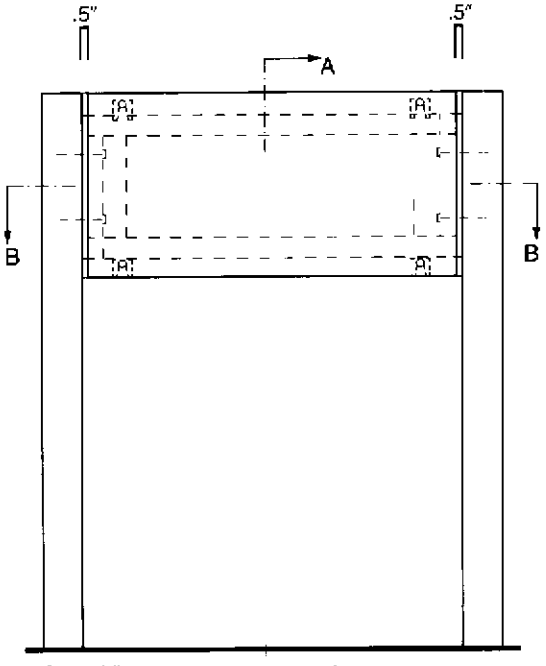
4a-b Panel attachment hardware. Hex bolt and receiving keyhole plates mount 4" inboard from outside edges of panel. For panels longer than 56" an additional bolt and keyhole plate should be placed at the center of panel along top and bottom. For attachment see detail 1, page B.7-1.

5 Frame assembly hardware. For attachment see detail 2, page B.7-1

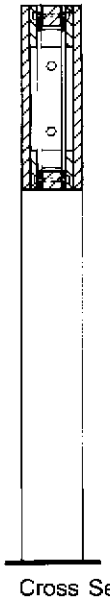
6 Frame attachment hardware.

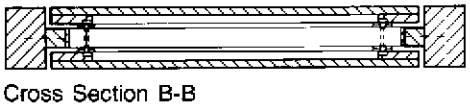


Exploded View



Front View


Cross Section A-A


Cross Section B-B

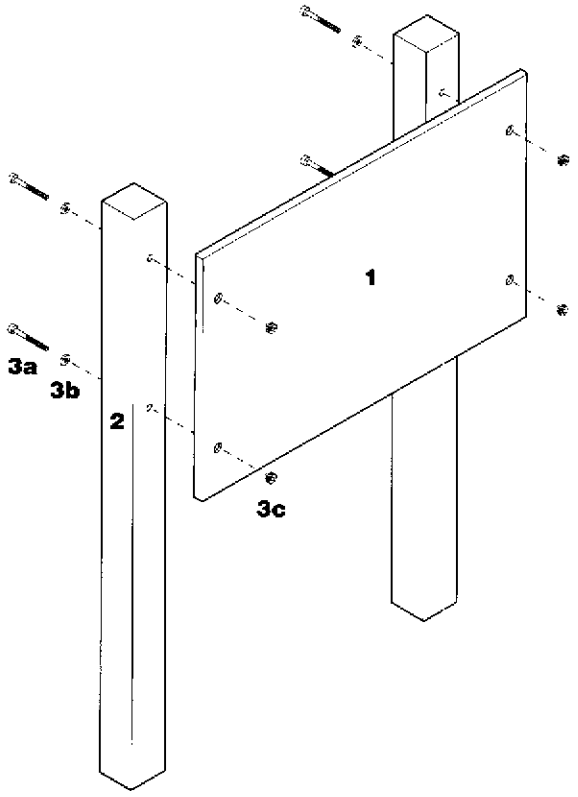
All items listed below shall conform to material specifications as described on page B.4-4b for HDO plywood signs, unless otherwise instructed on this page.

1 Panel, .75" thick.

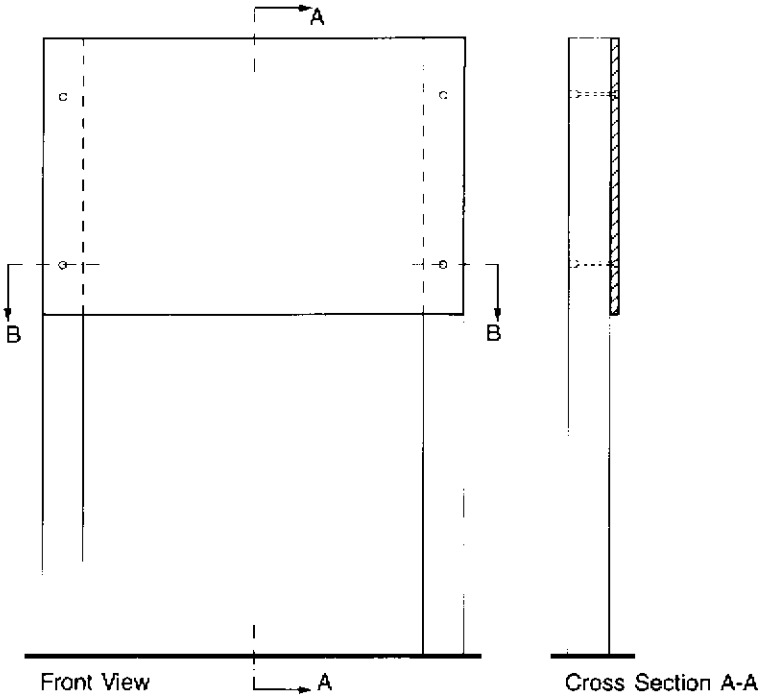
2 Solid or glue laminated post, 4" x 4", 4" x 6", 6" x 8", or 8" x 8". Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

3a-c Panel attachment hardware. For attachment see detail 5, page B.7-2.

NOTE: Double-faced signs shall be installed identical to single-faced signs, with a second sign panel mounted flush to the back of the sign post, see detail 6, page B.7-2. After mounting, cover socket head cap screw with circular patch of retro reflective sheeting matching panel sign face.



Exploded View



Front View

Cross Section A-A

Cross Section B-B

All items listed below shall conform to material specifications as described on page B.4-4a for HDO plywood signs, unless otherwise instructed on this page.

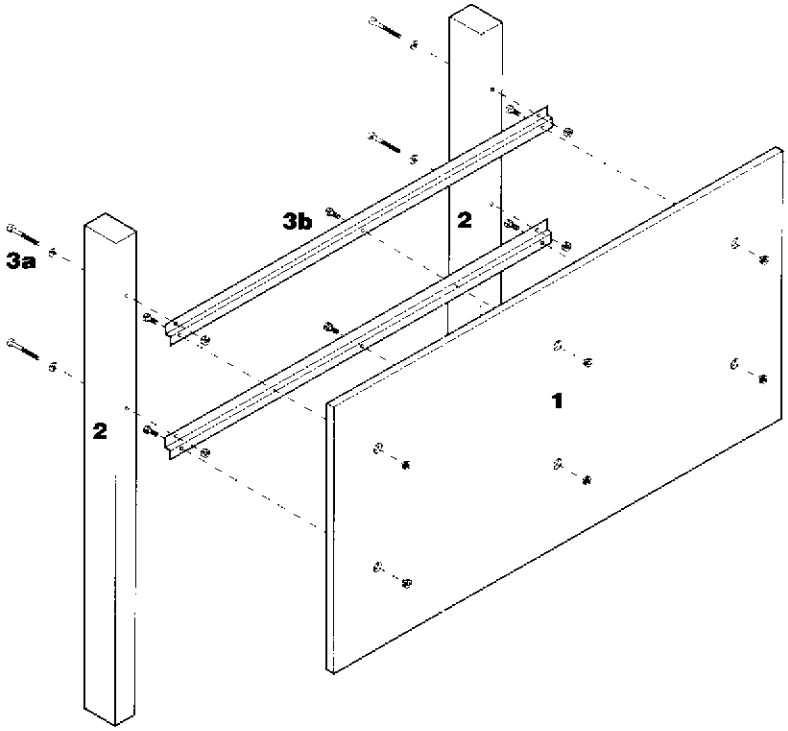
1 Panel, .75" thick. Panel may require reinforcement, using a "Z" bar attached to the back of the sign panel. See page B.4-4a for further specifications. Splices shall be fabricated as per manufacturers' instructions. In case a splice occurs at location of a "Z" bar, apply .75" HDO back piece(s) to act as full-length shims at location of other "Z" bar(s).

2 Solid or glue laminated post, 4" x 4", 4" x 6", 6" x 6", or 6" x 8". Post size shown here reflects the HAGL and does not include the section under ground. For footing and numbers of posts see pages B.2a-b and B.4-4a. An additional third post shall be positioned equally between the two other posts.

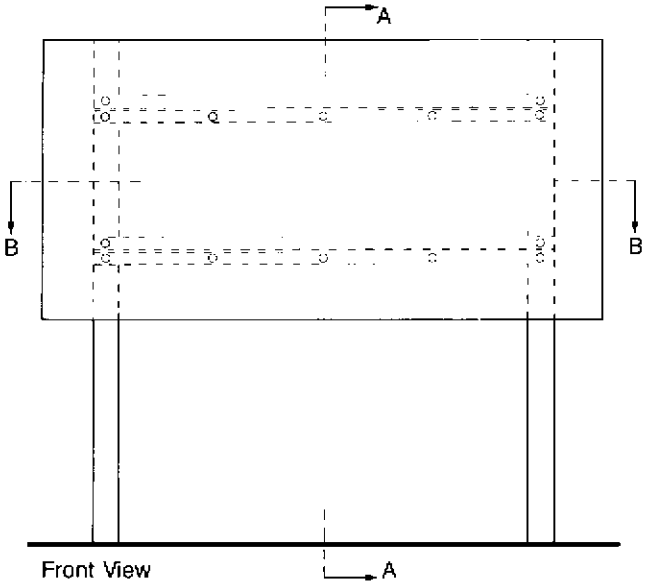
3a Panel attachment hardware, .375" socket head cap screws, .375" washers and 4-prong straight barrel T-nuts. T-nut to be countersunk and backfilled with Bondo or approved equal, flush to front of panel. Cap screw head to be countersunk a minimum of .25" below the surface of post. For attachment, see detail 5, page B.7-2.

3b Additional panel hardware, 3" x 2.6875" x 2.6875" "Z" bar .25" thick, .375" washers, .375" hex nuts, .25" 4-prong T-nuts, and .25" hex head cap screws. To be used when "Z" bar is applied for reinforcement, as specified in the diagram on page B.4-4a. For attachment, see detail 8, page B.7-3.

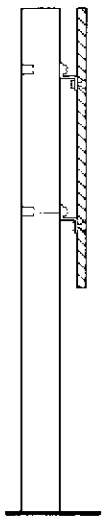
NOTE: Sign construction and panel attachment varies with panel size. For correct placement see following page B.4-4a.

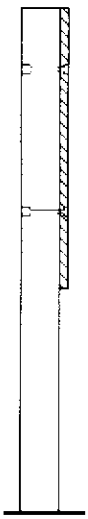


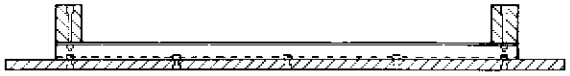
Exploded View

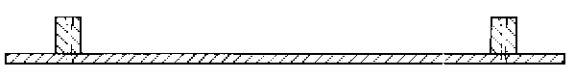


Front View


Cross Section A-A, With "Z" Bar


Cross Section A-A, Without "Z" Bar


Cross Section B-B, With "Z" Bar


Cross Section B-B, Without "Z" Bar

Approach Roadway Directional signs.

The diagram below identifies the specific design requirements to fabricate each different size of approach roadway directional sign as shown on page B.4. The first three columns identify the size of the panel and the following five columns list the correct size and number of parts to construct the sign.

Sign panels with a capital letter height of 9" shall follow intent of the basic construction drawings as shown on page B.4, but shall be engineered to meet local requirements on a site-by-site basis. Modifications may include, but are not limited to thicker panels, larger dimension posts, additional "Z" bars and larger footings.

Capital Letter Height	Maximum Panel Length	Panel Size (sq. in.)	Post Size	Post Number	"Z" Bar	Footing Cross Section	Footing Depth
4"	60"	0 - 2500	4" x 6"	2	0	1' - 6"	4' - 0"
	80"	0 - 1400	4" x 4"	2	2	1' - 6"	4' - 0"
		1400 - 3000	4" x 6"	2	2	1' - 6"	4' - 0"
		3000 - 3400	4" x 8"	2	2	2' - 0"	4' - 0"
	96"	0 - 2700	4" x 6"	2	2	1' - 6"	4' - 0"
		2700 - 4200	4" x 8"	2	2	2' - 0"	4' - 0"
	104"	0 - 2900	4" x 6"	2	2	1' - 6"	4' - 0"
		2900 - 4500	4" x 8"	2	2	2' - 0"	4' - 0"
6"	84"	0 - 3200	6" x 6"	2	2	1' - 6"	4' - 0"
		3200 - 4200	6" x 6"	2	2	1' - 6"	4' - 0"
		4200 - 5200	6" x 8"	2	2	2' - 0"	4' - 0"
	102"	0 -2700	6" x 6"	2	2	1' - 6"	4' - 0"
		2700 - 3700	6" x 6"	2	3	1' - 6"	4' - 0"
		3700 - 6700*	6" x 8"	2	3	2' - 0"	4' - 0"
	120"	0 - 4500	6" x 6"	3	0	1' - 6"	4' - 0"
		4500 - 5800	6" x 6"	3	0	2' - 0"	4' - 0"
		5800 - 7800*	6" x 8"	3	0	2' - 0"	4' - 0"
	138"	0 -5000	6" x 6"	3	0	1' - 6"	4' - 0"
		5000 - 9000*	6" x 8"	3	0	2' - 0"	4' - 0"
	156"	0 -6400	6" x 6"	3	2	2' - 0"	4' - 0"
		6400 - 7800	6" x 8"	3	2	2' - 0"	4' - 0"
		7800 - 10,200*	6" x 8"	3	3	2' - 0"	4' - 0"

*Panel may require horizontal splice in HDO

Project Roadway Directional signs.

The diagram below identifies the specific design requirements to fabricate each different size of project roadway directional sign as shown on page B.4. The first three columns identify the size of the panel and the following five columns list the correct size and number of parts to construct the sign.

Capital Letter Height	Maximum Panel Length	Panel Size (sq. in.)	Post Size	Post Number	"Z" Bar	Footing Cross Section	Footing Depth
2"	54"	0 - 1100	4" x 4"	2	0	1' - 6"	4' - 0"
3"	60"	0 - 1800	4" x 6"	2	0	1' - 6"	4' - 0"
	78"	0 - 2400	4" x 6"	2	2	1' - 6"	4' - 0"
4"	60"	0 - 2400	4" x 6"	2	0	1' - 6"	4' - 0"
	86"	0 - 3800	4" x 6"	2	2	1' - 6"	4' - 0"

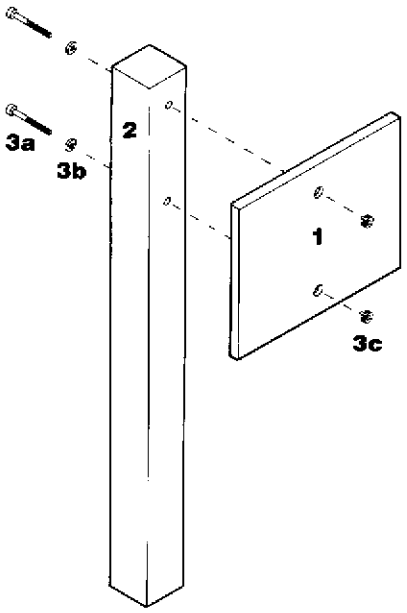
All items listed below shall conform to material specifications as described on page B.4-4b for HDO plywood signs, unless otherwise instructed on this page.

1 Panel, .75" thick. Panels using a sign type code "PS" shall have corners with a radius matching the outside borderline provided on the artwork (see page 8.31). All other sign types shall have the specified safety radius.

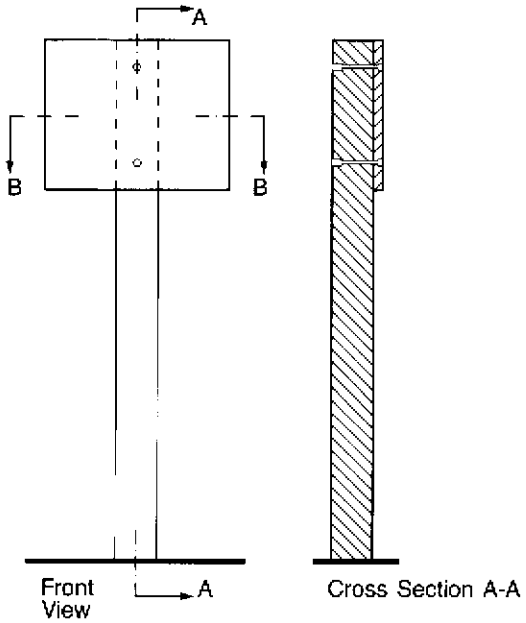
2 Solid or glue laminated post, 4" x 4" or 4" x 6". Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b,

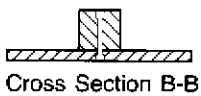
3a-c Panel attachment hardware. For attachment see detail 5, page B.7-2.

NOTE: Double-faced signs shall be installed identical to single-faced signs, with a second sign panel mounted flush to the back of the sign post, see detail 6 page B.7-2. After mounting, cover socket head cap screw with circular patch of retro reflective sheeting matching panel sign face.



Exploded View




Cross Section B-B

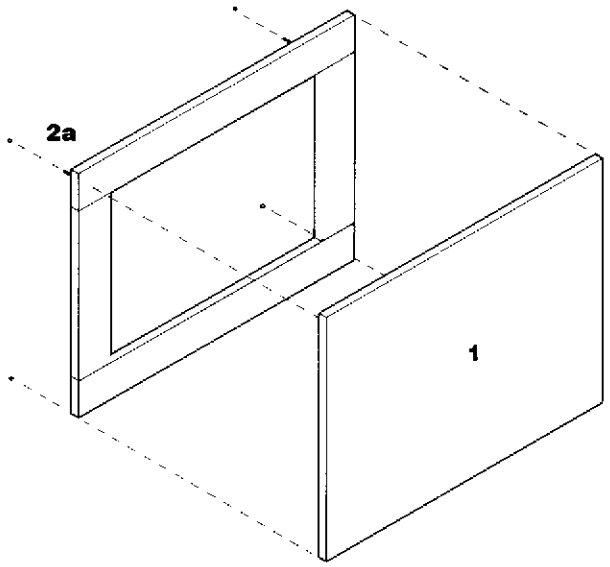
All items listed below shall conform to material specifications as described on page B.4-4b for HDO plywood signs, unless otherwise instructed on this page.

1 Panel, .75" thick backed with 4" x .75" HDO strips, glue laminated flush to the edge of the panel. Strips to be laminated prior to finish work.

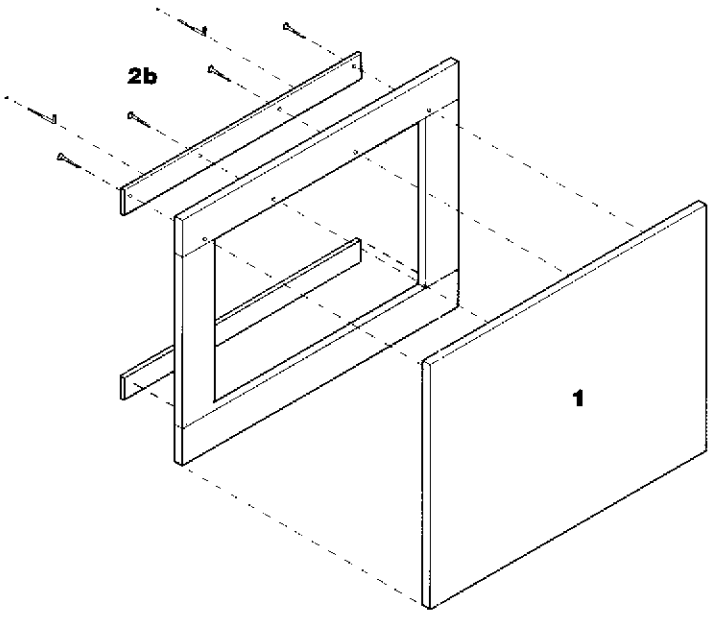
2a Panels no greater than 24" x 36" shall be attached to wall surfaces using threaded studs permanently affixed square to the face of the panel.

Silicone adhesive shall be used in wall holes receiving the threaded studs, and in generous amount on the remainder of the sign back. Wall surface shall be clean and free of loose particles to promote good adhesion of silicone. Use foam tape or other temporary bracing until permanent adhesives are set.

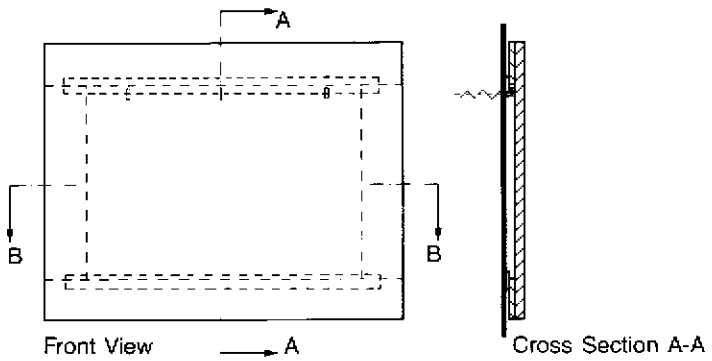
2b Panels greater than 24" x 36" shall be attached to wall surfaces using a metal cleat, receiving hardware in a routed slot. Metal cleat shall be .125" aluminum, 2" wide with length 8" less than width of sign. It shall be screwed securely to the back of the sign face with No.12 flat head Phillips zinc plated wood screws. Cleat is to overlap routed groove with sufficient clearance to receive wall hardware. Appropriate hardware for wall material shall be used to securely fasten the panel (i.e. lead anchors, hollow-wall anchors, lag bolts, etc.). Silicone adhesive may be used in addition to mechanical fasteners to permanently secure sign panel to wall surface.



Exploded View (2a)



Exploded View (2b)



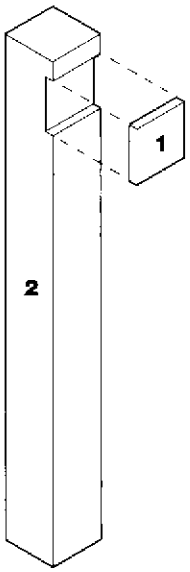
Front View Cross Section A-A

Cross Section B-B

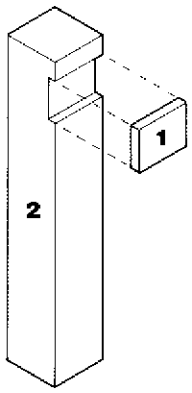
All items listed below shall conform to material specifications as described on page B.4-4b for HDO plywood signs, unless otherwise instructed on this page.

1 Panel, .75" thick, to be laminated to sign post with silicone adhesive.

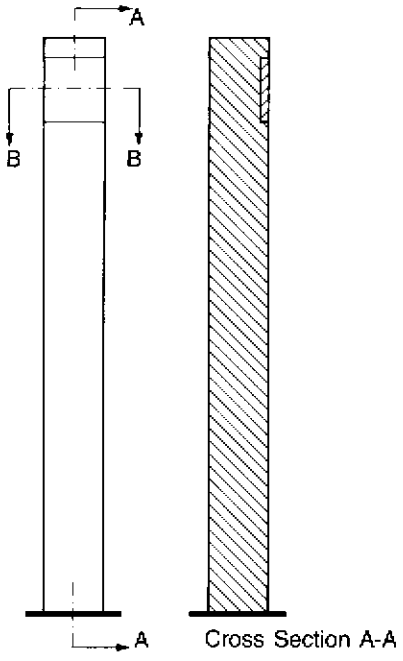
2 Solid or glue laminated post, 6" x 6". Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.



Exploded View

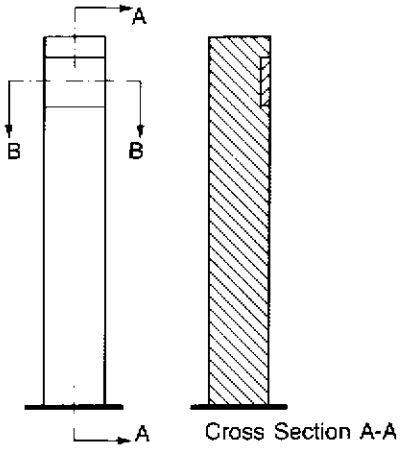


Exploded View



Cross Section A-A

Cross Section B-B



Cross Section A-A

Cross Section B-B

All items listed below shall conform to material specifications as described on page B.4-4b for HDO plywood signs, unless otherwise instructed on this page.

1a Face panel and strip, .75" thick and backed with a .5" back panel. Panel and strip to be laminated prior to finish work.

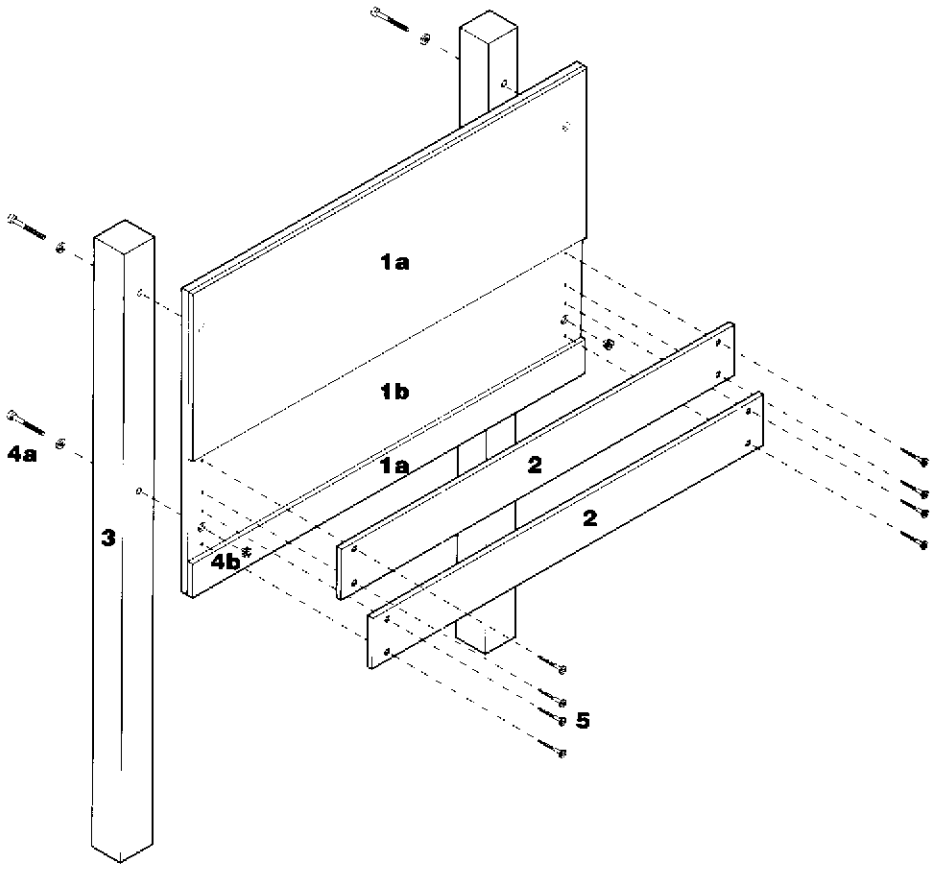
1b Back panel, .5" thick. Front face of back panel receiving insertion panels shall be painted as described on page B.4-4a.

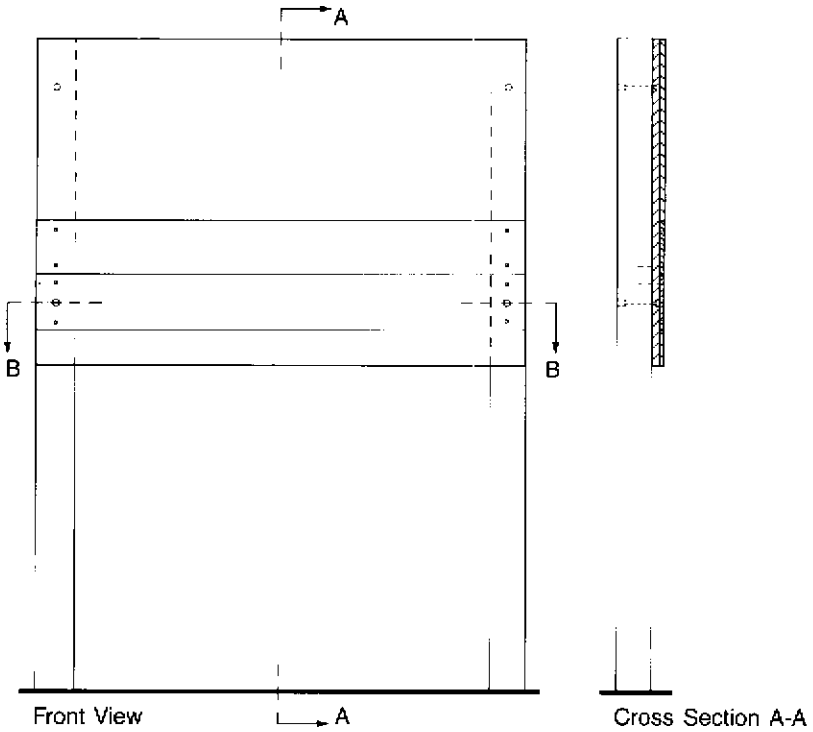
2 Insertion panels, .75" thick. To be attached with No.12 flat head wood screws. Each insertion panel shall be finished as an individual sign panel.

3 Solid or glue laminated post, 4" x 4". Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

4a-b Panel attachment hardware. For attachment see detail 5, page B.7-2. Hardware on top of the panel ("T"-nut) shall be inserted in back panel prior to lamination of face panel.

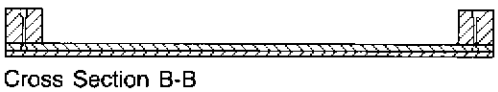
5 Insertion panel hardware, No. 12 flat head wood screws.





Front View

Cross Section A-A



Cross Section B-B

All items listed below shall conform to material specifications as described on page B.4-4b for HDO plywood signs, unless otherwise instructed on this page.

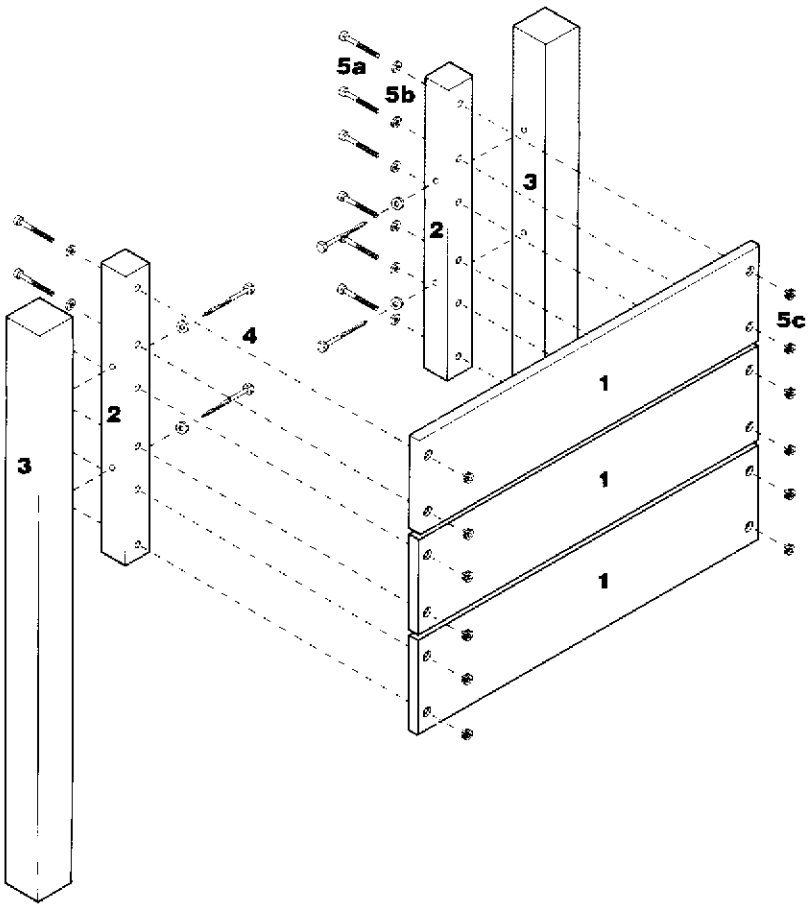
1 Panel, 1" thick. Panels shall be attached to brace, leaving a .5" reveal between panel and post.

2 Brace, 2.5" x 2.5" Redwood lumber. Length of brace to be sized according to the number of panels to be attached, including a .5" space between each panel.

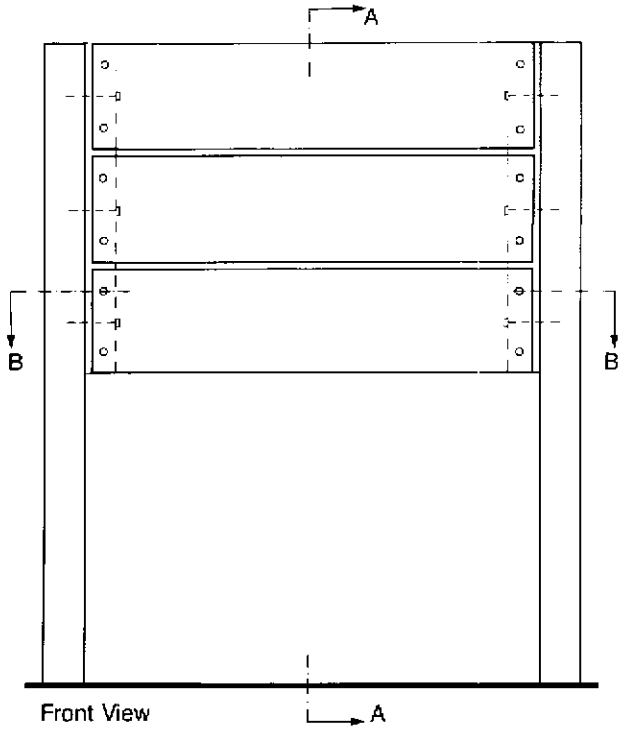
3 Solid or glue laminated post, 4" x 4". Post size shown here reflects the HAGL and does not include the section under ground. For footing see page B.2a-b.

4 Brace attachment hardware shall be .375" x 5" lag bolts and .375" washers. Two or three slats shall use two (2) lag bolts per brace, four slats must use three (3) lag bolts per brace.

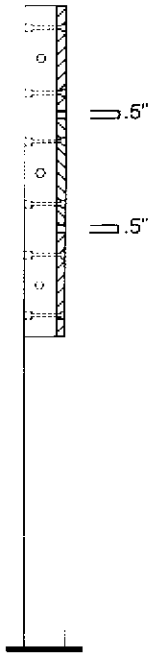
5a-c Panel attachment hardware. For attachment see detail 5, page B.7-2.



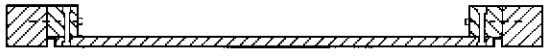
Exploded View



Front View



Cross Section A-A



Cross Section B-B

1. Materials

1.1 Signs

Panels shall be fabricated from Aluminum 6061-T6 alloy as per ASTM B209, to meet or exceed standards as specified in FP-85 Section 719.03. Surface of panel shall be commercially flat and free of buckles, warps, dents, cockles, burrs and any fabrication defects. Panel thickness shall depend on total square footage of surface and maximum dimension.

Square Inch	Maximum Dimension	Panel Thickness
<900	<30"	.080"
<900	>30"	.125"
>900	<30"	.125"
>900	>30"	.125"

Dimensions for panels shall have a tolerance of ±.125".

No cleats or joints shall be permitted for panels up to 900 square inches with no dimension greater than 30". All other panels shall require reinforcement using a metal framework.

Panels shall have corners with a safety radius of 1" unless otherwise specified.

Metal frame shall be fabricated from Aluminum 6061-T6 "Z" bar, 3" x 2 11/16" x 2 11/16". Construction, attachment and placement is described on specific sign panel pages where reinforcement may be required

Solid post shall be fabricated of one piece construction heart Redwood lumber, per grading rules of the California Redwood Association, or better. For dimensions larger than 4" x 4", treated Douglas Fir No.1 or better; Southern Yellow Pine No.1 or better shall be used. All post sizes shall be .5" less than nominal dimensions, and will be sanded smooth prior to finishing. All materials shall be well-seasoned and free of any defects. Douglas Fir and Yellow Pine shall be weathered a minimum of one (1) year after installation prior to stain application.

Glue-laminated post can be used as an alternate for dimensions 4" x 6" or larger and shall be constructed of clear heart, kiln-dried Redwood only.

All complete sign panel and post assemblies must be pre-drilled and assembled in the shop prior to shipment to check alignment and ensure proper fit once installed. Panels manufactured as separate units shall be pre-drilled with hardware inserted in place.

1.2 Hardware

Panel hardware shall be .375" socket head cap screws, .375" washers and plastic or metal capped nuts. Cap screw to be countersunk a minimum of .25" below the surface of the post.

Metal frame attachment shall be rivets, specified on fabrication drawings.

1.3 Laminates

Adhesive for post construction shall be phenolic resornicol moisture resistant, or approved equal. Application must be performed within 15 minutes between the first glue application and the final setting of the clamps. The surface of each joint face shall be completely covered with adhesive Glued posts to cure for a minimum of 24 hours with clamps in place.

Air temperature shall be between 70-90 degrees Fahrenheit during drying of boards, glue application and curing process. Boards to be stacked on drying racks and dried not less than 24 hours prior to gluing.

Moisture contents of lumber to be glued shall be between 12-15%, with a 3% margin between wettest and driest piece.

Surface joints shall be smooth and true, free from machine joining marks and chipped or loosened grain.

1.4 Finishes

Stain shall be semi-transparent waterproof, anti-bacterial redwood stain to match Corps Brown, Olympic brand redwood stain No. 715, or approved equal. Apply with brush or roller to all exposed surfaces of sign panel and posts. Stain shall be thoroughly mixed prior to and during application to ensure even pigmentation. Posts will be dried a minimum of 24 hours prior to shipping.

Paint room facilities shall be well-ventilated, dust-free and enclosed. Air temperature shall not be less than 65 degrees F during application of paint.

2. Graphics

2.1 Retro-reflective sheeting

Background and legend shall be engineer grade, premium quality, wide angularity enclosed lens retro-reflective material to meet or exceed the standards of:

– General Services Administration, Federal Supply Service specification *L-S-300-C, Reflectivity 1.*

– U.S. Department of Transporation, Federal Highway Administration, *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects*, current edition *FP-85 Sections 633.06* and *718.01.*

Background and legend shall use sheeting from the same manufacturer. Mixing of sheeting from different manufacturers shall not be permitted.

No more than twelve (12) months will have elapsed from date of purchase to the date of application.

Background application to aluminum shall be as described by the manufacturer and approved by the designated representative of the Corps of Engineers. Corps Brown and all highway colors may be either pressure-sensitive or heat-activated applied. Special waterway colors are only available with pressure-sensitive adhesive.

Panels shall be covered with one unspliced sheet, unless the dimension is larger than 48″ in vertical direction. Splices shall be positioned so as not to fall within legends. Top piece shall overlap bottom piece by a minimum of .5″, but not more than .75″. Spliced sheets shall be color matched.

Background shall be adhered to front of sign panel prior to legend applications.

Legend application shall be as described by the manufacturer and approved by the designated representative of the Corps of Engineers and may be either pressure-sensitive or heat-activated applied. No loose or curled edges, bubbles or blisters shall be permitted.

Legend shall be adhered to background after application of background sheeting to sign panel.

Heat-activated sheeting shall be double-cycled through the vacuum applicator, one time when applying the background sheeting and one time when applying the legend.

2.2 Silkscreen

Silkscreening shall only be applied to Traffic Signs, Prohibition Symbol Signs, Boundary Markers, Trail Markers and Fee Symbols. No application shall be permitted for signs with Corps Brown background or any Danger or Warning sign as shown in Sections 7, 8, 9 and 14 of this manual.

Formulation cards shall be filed for each individual ink color to ensure consistency of the product. Filed information shall include, but is not limited to, ink formula with designated color code, thinner and retarder adjustments in grammes, batch numbers of inks, thinner and retarder, mesh tension, emulsion coating and exposure units/time. When semi or fully automatic equipment is used, additional information shall be filed for: off contact, peel, speed, squeegee, flood speed, curing temperature and belt speed.

Inks shall have a light fastness rating of 7-8 on the din 16525 (Wool Scale) or equivalent industry standard, and must be able to withstand 375 degrees Fahrenheit (190 degrees Celsius) without noticeable change off pigmentation.

Ink type shall be acceptable to manufacturer of substrate.

Inks shall be formulated using a computer colorimetry system and shall be matched with a tolerance of ±0.1 grammes.

Colors shall conform to the listing in Section 4 in this manual.

Thinner and retarder used in the adjustment of the inks shall be specified by the ink manufacturer. Additions shall be made by weight with a tolerance of ±0.1 grammes and filed on the formulation card.

Screens shall be 254 polyester monofilament, mesh tensioned to no less than 18 newtons. Mesh tension, emulsion coating and exposure units/time are to be established and filed on the formulation card.

Printing shall be performed on semi or fully automatic equipment with a repeatability tolerance of ±.004″ in conjunction with a forced air conveyor drier. Off contact, peel, speed, squeegee, flood speed, curing temperature and belt speed are to be established and filed on the formulation card.

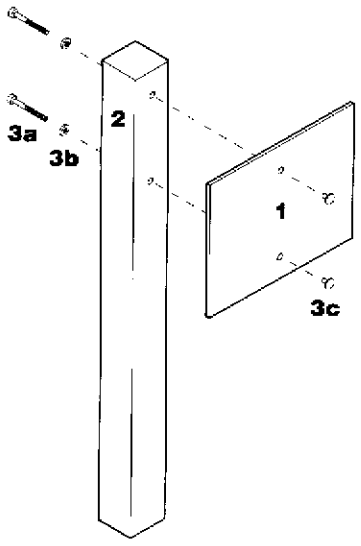
A fiberglass laminated urethane squeegee set at a 75 degree angle is to be used.

All items listed below shall conform to material specifications as described on page B.5-5a for aluminum signs, unless otherwise instructed on this page.

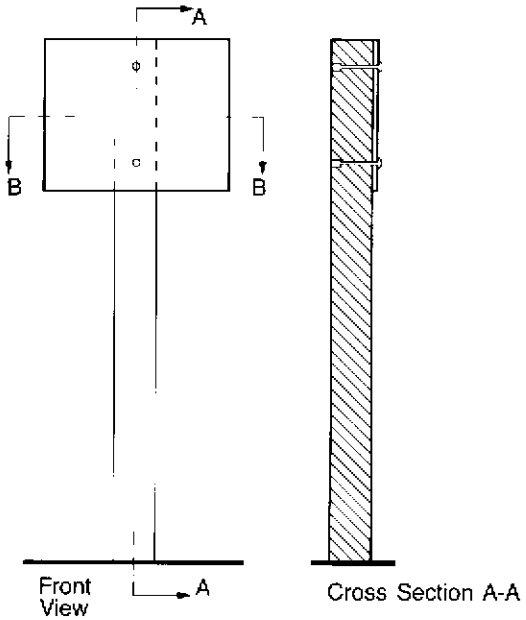
1 Panel, .080" or .125" thick. Panels using a sign type code "PS" shall have corners with a radius matching the outside borderline provided on the artwork (see page 8.31). All other sign types shall have the specified safety radius.

2 Solid or glue laminated post, 4" x 4" or 4" x 6". Post size shown here reflects the HAGL and does not include the dimension under ground necessary to install the sign.

3a-c Panel attachment hardware. For attachment see detail 5, page B.7-2.



Exploded View




Cross Section B-B

All items listed below shall conform to material specifications as described on page B.5-5a for aluminum signs, unless otherwise instructed on this page.

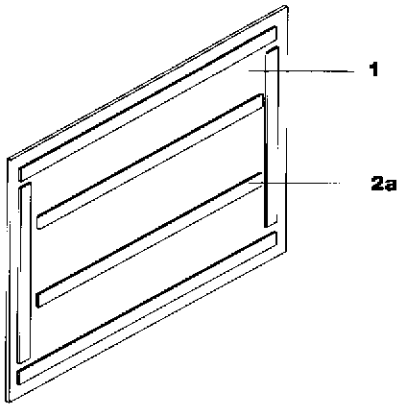
1 Panel, .080" or .125" thick.

2a Panels no greater than 24"x 36" may be attached to wall surface with silicone adhesive if surface allows good adhesion. Wall surface shall be clean and free of loose particles to promote good adhesion of silicone. Use foam tape or temporary bracing until permanent adhesives are set.

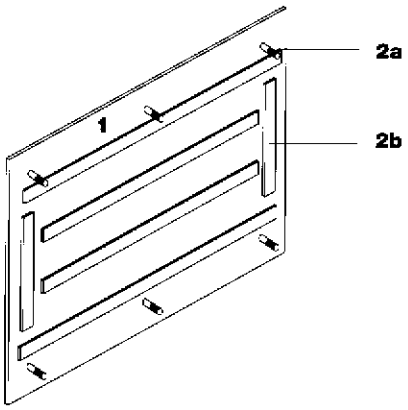
2b Panels larger that 24"x 36" shall be attached to wall surface with .25" threaded stud protruding 1" from back of sign and small panels where stud mounting provides added resistance to removal. Studs shall be permanently affixed square to the face of the panel at intervals no greater than 18" between the studs. Minimum dimension to the edge of the panel shall be 2". Silicone adhesive shall be used in wall holes receiving the threaded studs, and in generous amounts on the remainder of the sign back. Excess adhesive shall be scraped off sign edge and wall surface for tailored looking attachment.

2c If wall surface is not even enough to use either of the two methods mentioned above, a wood frame, made from 1"x 4" redwood, may be constructed to receive the aluminum panel using .25" threaded studs protruding 1.5" from back of sign, to secure the panel to the wall or surface.

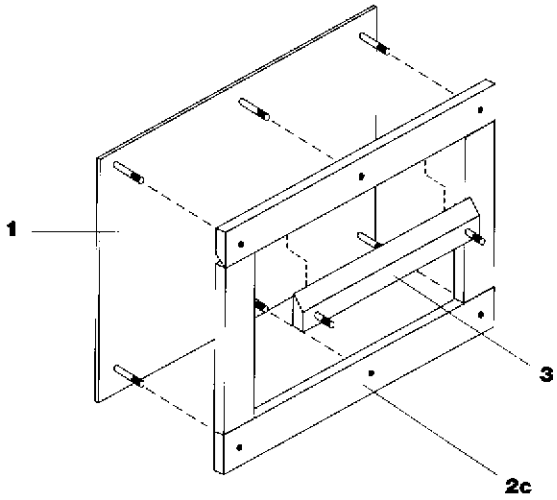
3 An optional beveled receiving cleat may be used to assure that the panel is attached on level and carry panel weight until adhesives are set.



Side View



Side View



Side View

1. Materials

1.1 Signs

Acrylic sheet shall be premium quality as manufactured by Rohm and Haas, American Cyanamid, E.I. DuPont or approved equal. All edges shall be smooth and free from any saw marks, chips, cracks or other blemishes and shall be square to the face.

All surfaces shall be free of scratches, stains or other imperfections and shall be treated with antistatic polish.

All drilled holes shall be clear of chips or shavings.

Polyethylene shall be modified high density linear polyethylene with a density of .965 gram/cc. Ultra Violet inhibitor shall be added with a V.V.I./Polyethylene ratio no less than 1% by weight added at time of extrusion. Temperature range shall be −180 to 200 degrees Fahrenheit.

Retro-reflective sheeting shall be engineer grade, premium quality, wide angularity enclosed lens retro-reflective material to meet or exceed the standards of:
— Federal Supply Service, General Services Administration *L-S-300-C, Reflectivity 1.*
— U.S. Department of Transportation, Federal Highway Administration, *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects.* current edition *FP-85 Sections 633.06* and *718.01.*

No more than twelve (12) months will have elapsed from date of purchase to the date of application.

Solid post shall be fabricated of one piece construction heart Redwood lumber, as per grading rules of the California Redwood Association, or better. For dimensions larger than 4" x 4", treated Douglas Fir No.1 or better; Southern Yellow Pine No.1 or better shall be used. All post sizes shall be .5" less than nominal dimensions, and will be sanded smooth prior to finishing. All materials shall be well-seasoned and free of any defects. Douglas Fir and Yellow Pine shall be weathered a minimum of one (1) year after installation prior to stain application.

Flexible post shall be Carsonite CIB-380R (brown), as manufactured by Carsonite International, or approved equal. Minimum length of post shall be 60".

1.2 Finish

Stain shall be semi-transparent waterproof, anti-bacterial redwood stain to match Corps Brown, Olympic brand redwood stain No.715, or approved equal. Apply with brush or roller to all exposed surfaces of posts. Remove excess paint by wiping with dry cloth. Stain shall be thoroughly mixed prior to, and during, application to ensure even pigmentation.

All complete sign panel and post assemblies must be pre-drilled and assembled in the shop prior to shipment to check alignment and ensure proper fit once installed. Panels manufactured as separate units shall be pre-drilled with hardware inserted in place, unless otherwise specified.

2. Graphics

2.1 Silkscreen

Inks shall be non-glare, "Eggshell" or semi-matte, and shall be compatible to substrate. Retro-reflective sheeting shall use fade-resistant inks. Polyethylene panels shall use epoxy resin inks.

Paint shall be compatible to material to which it is applied, and shall be guaranteed not to cause discoloration, deterioration or delamination for any reason, including exposure to heat, sunlight, weathering or other environmental conditions. All painted surfaces shall have a smooth even finish and be free of imperfections, marks, scratches, dirt embedments, wave patterns and other irregularities. Paint shall be applied using a high pressure spray in dust-free conditions and shall be thoroughly dried before being moved or assembled.

All colors shall be reproduced exactly as specified in section 4 of the Graphics Standards Manual. All color matches shall be approved by the National Sign Coordinator prior to fabrication.

Paint room facilities shall be well-ventilated, dust-free and enclosed. Air temperature shall be less than 65 degrees Fahrenheit during application of paint.

Silkscreens shall be produced using same size photographic film positives. Hand-cut or projection-produced screens shall not be permitted.

All items listed below shall conform to material specifications as described on page B.6 for screen-printed signs, unless otherwise instructed on this page.

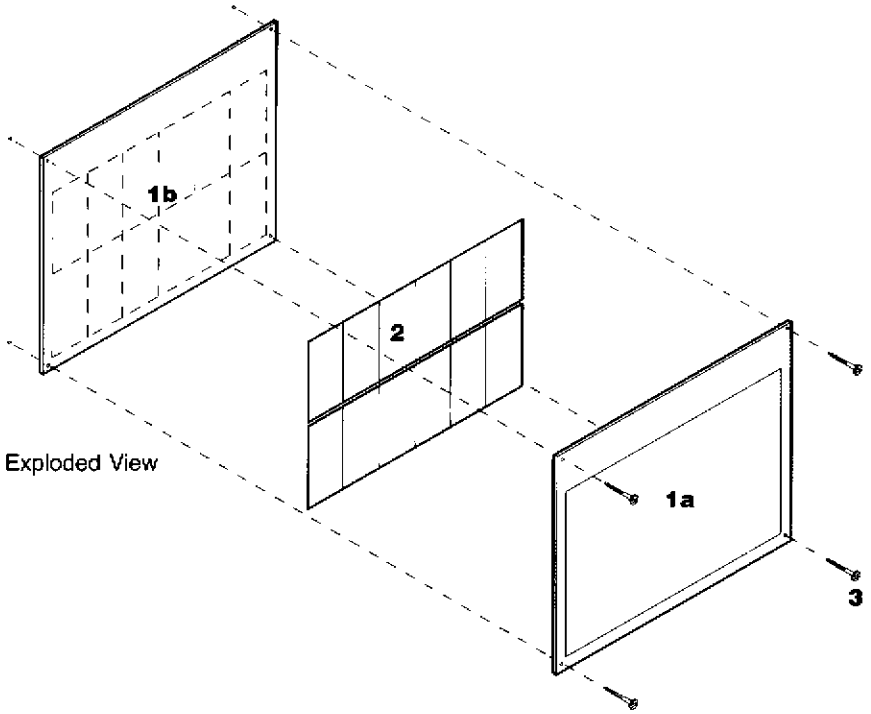
1a Acrylic front panel, subsurface silkscreened. Indicated rectangle shall remain clear to accommodate the printed sheet of "Rules and Regulations".

1b Acrylic back panel, surface painted. Panel to receive sheet of "Rules and Regulations" at same location as clear rectangular window of front panel. Acrylic sheets shall be "sandwiched" and mounted with appropriate hardware (depending on surface). Edges shall be sealed with clear silicone adhesive to prevent moisture from entering.

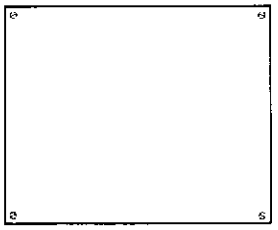
2 8.5" x 22" printed sheet of "Rules and Regulations", as provided by the National Resources Management Branch.

3 Hardware shall be appropriate to surface on which panel is mounted.

COLORS: Corps Castle Logo and "Rules and Regulations" shall be white subsurface silkscreened. The background with the indicated clear rectangle shall be Corps Brown, subsurface silkscreened or painted. Front face of back panel shall be white surface painted.



Exploded View


Front View


Side View


Plan

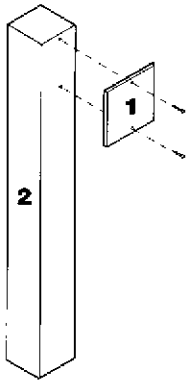
All items listed below shall conform to material specifications as described on page B.6 for screen-printed signs, unless otherwise instructed on this page.

1 Polyethylene panel, surface silkscreened and mounted on specified post or on existing structures and/or trees as specified by the local project manager.

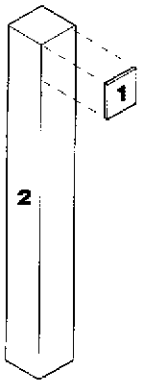
2 Solid post, 4" x 4". Post size shown here reflects the HAGL and does not include the section under ground.

3 Hardware shall be appropriate to surface on which panel is mounted.

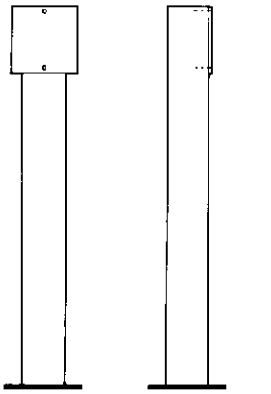
NOTE: Panels installed on existing structures or vegetation shall use a common height to create an orderly look.



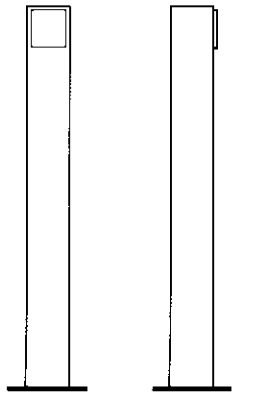
Exploded View



Exploded View


Front View Side View

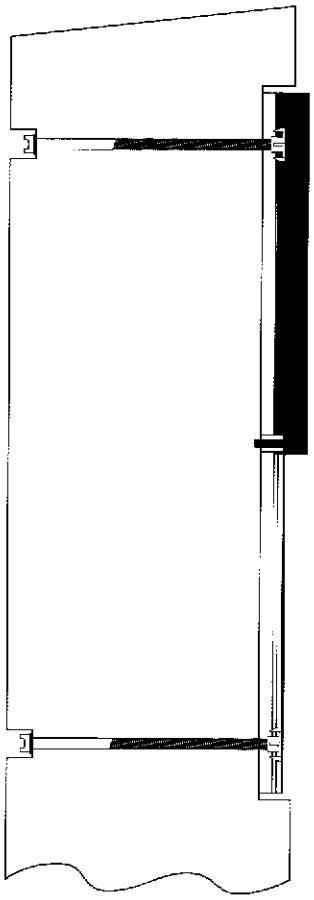
Plan


Front View Side View

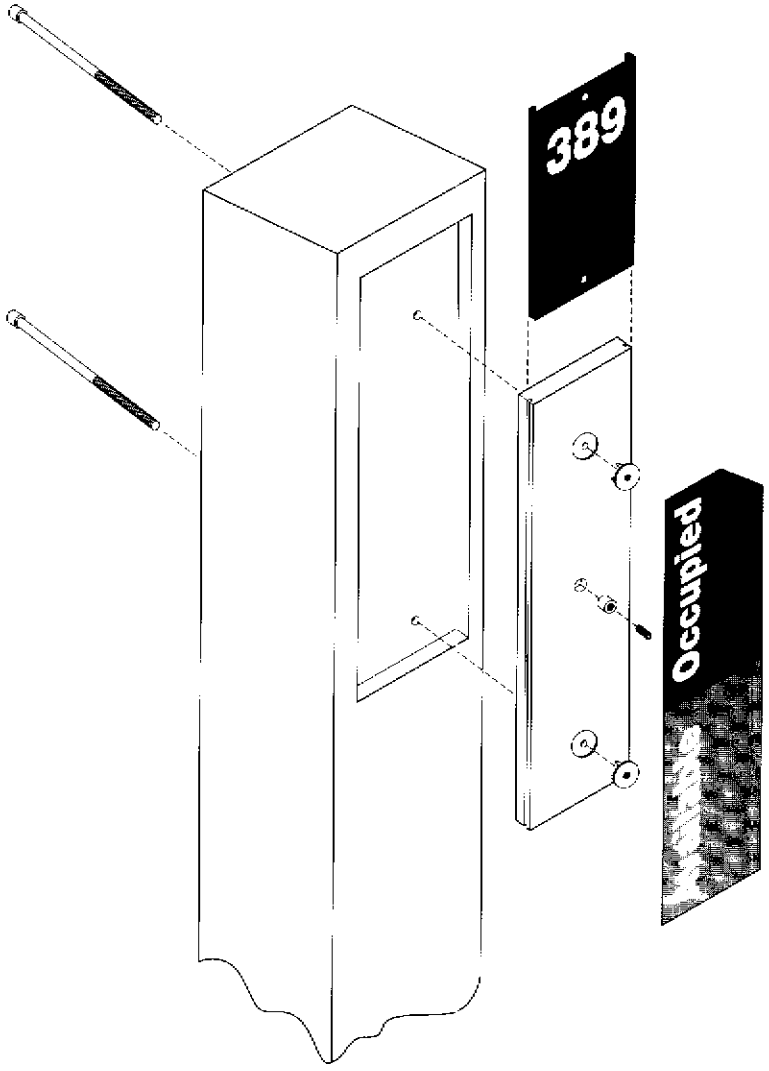
Plan

Site Availability Boards were developed in Nashville District (J. Percy Priest Lake) to assist campers when entrance stations are not staffed by park attendants. The Site Availability Boards allow the entrance to be unattended for several hours of the day by identifying occupied and vacant sites for incoming campers. This is especially important where reservations for campsites are taken and reserved sites would not readily be identifiable. Rangers can also use the boards to identify campers fees; the board can be changed to the "Occupied" position when the fees are collected. The Site Availability Board system allows reduced park attendant hours, provides campers with site information, and assists rangers in collecting fees.

The Site Availability Board is constructed of a solid plastic board placed on a datoed 6" x 6" wood post. The board has grooved sides, which allows an aluminum slide to be moved up and down to display either the "Available" or "Occupied" messages. The messages are cut and applied white, engineer-grade retro-reflective sheeting applied to retro-reflective sheeting base color; green for "Available" and red for "Occupied." The lock is an allen set screw, simple in design and easy to use. When attached to a treated 6" x 6" post, the Site Availability Board makes an attractive campsite identification system.



Side Elevation



Exploded View

Site Availability Board Specifications

Post: Stained 6" x 6" dimensional post with beveled top (1:6), redwood or treated Douglas fir or treated Southern Yellow Pine with 0.5" x 15" datoed insert for attachment of panel.

Post Stain: Opaque (solid color) Corps Brown

Panel: Machined impact resistant plastic 4" x 15" x 0.5" with machined 0.09375" (w) x 0.15625" (d) slide groove inset 0.09375" and extending 15" on both outside edges.

Adjustable slide: Painted extruded aluminum, 4.125"(W) x 7.75"(L) x 0.625" (T) slide with 0.25" x 0.1875" double return.

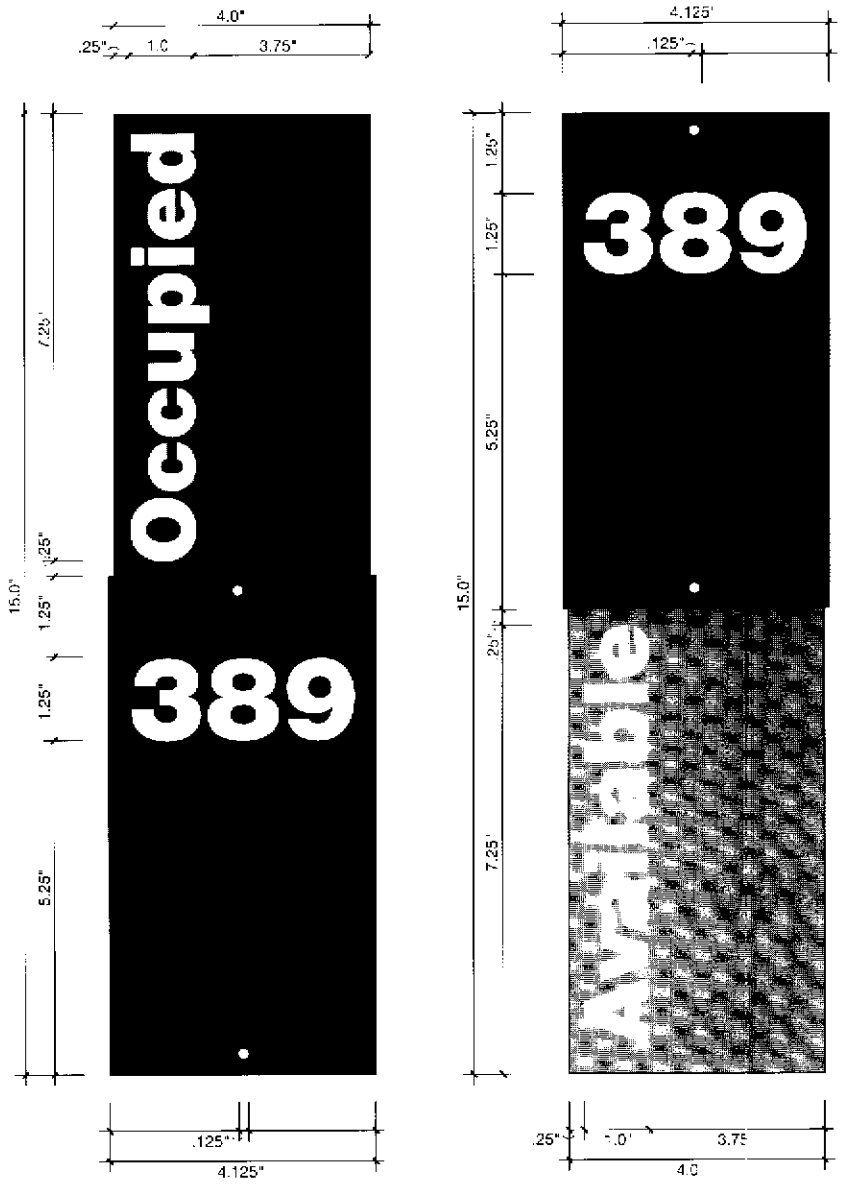
Slide stop: 0.375" threaded insert in plastic panel with 0.05625"x 0.375" allen head set screw.

Slide finish: Acrylic polyurethane, color Corps Brown with Corp Brown reflective sheeting face.

Assembly attachment: Subsurface 0.187" T-nut with rear mount, counter sunk, 0.187" allen head bolts.

Graphics on panel: 2 sections 4" x 7.5" (4" x 15" total)
Color: Top section: Red (3M-3262) Engineering grade reflective sheeting, bottom section: Green (3M-3267) Engineering grade reflective sheeting.

Graphics: White (3M-3260) computer cut Engineering grade reflective sheeting.
Campsite number: 1.25" Helvetica Bold aligned as shown.
Availability information: 1.0" Helvetica Bold, upper and lower case, aligned on vertical as shown.

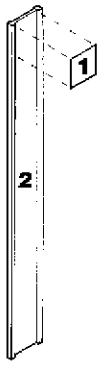


Legend Grid

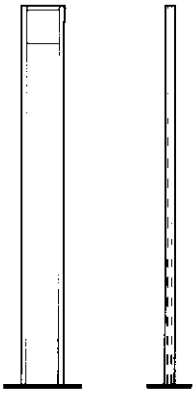
All items listed below shall conform to material specifications as described on page B.6 for screen-printed signs, unless otherwise instructed on this page.

1 Retro-reflective panel, positioned with equal space to the left, right and top of the post. Multiple panels shall have the same spacing individually.

2 Flexible post.



Exploded View



Front View Side View

Plan

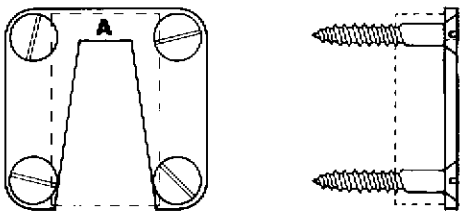
Detail 1

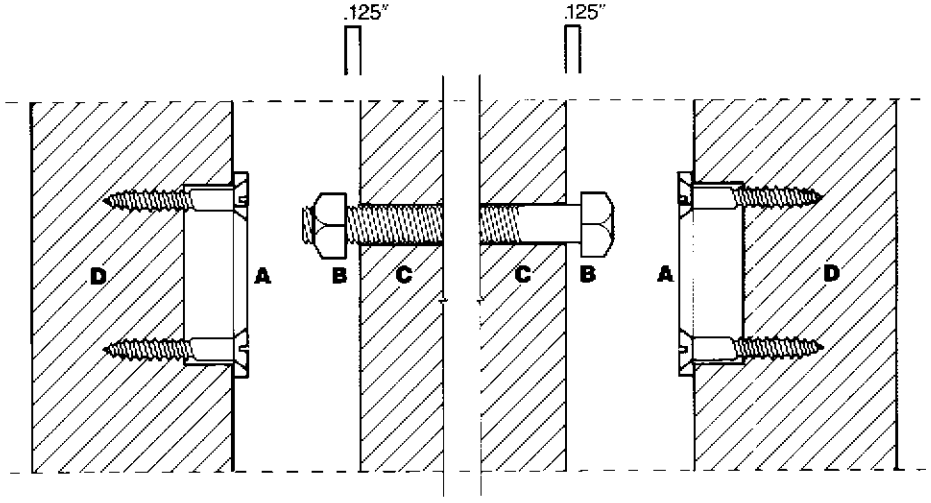
A 2" x 2" aluminum keyhole receiving plate, attached to the back of the panel. Area with dotted line indicates a routed slot, necessary to receive the hex head or nut.

B .375" lag bolt with .5625" hex head and .5625" hex nut. Bolt shall be threaded through frame leaving .125" of shaft exposed on either side after attaching hex nut.

C 2" x 4" or 4" x 4" frame.

D Sign panel.



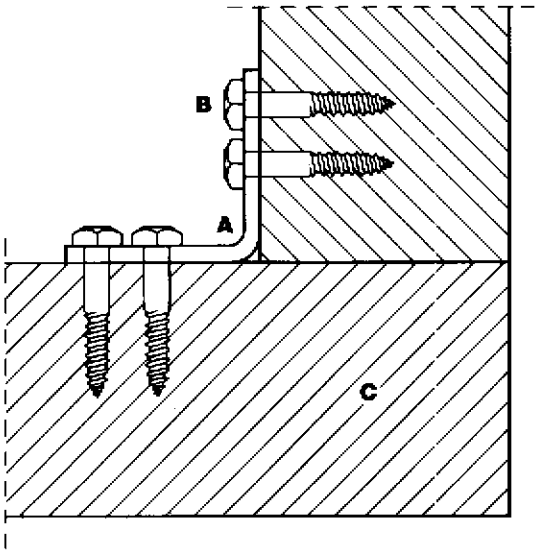


Detail 2

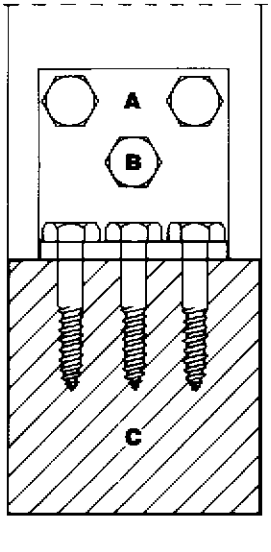
A 2" x 2" or 3" x 3" aluminum angle bracket.

B .375" lag bolt, or approved equal.

C 2" x 4" or 4" x 4" frame.



Side View



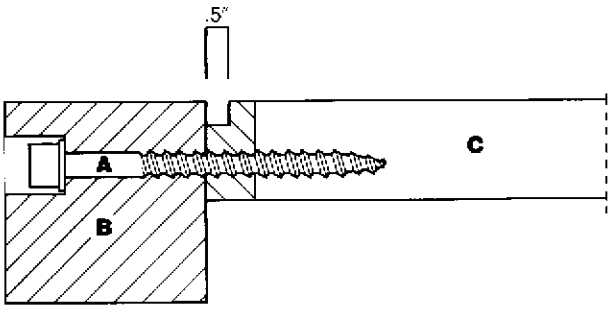
Front View

Detail 3

A .3125" socket head cap screw and .3125 " washer, countersunk at least .25" from the surface of the sign post.

B Solid or glue laminated post.

C Sign panel with 2" x 1.25" routed endstrip creating a .5" reveal.

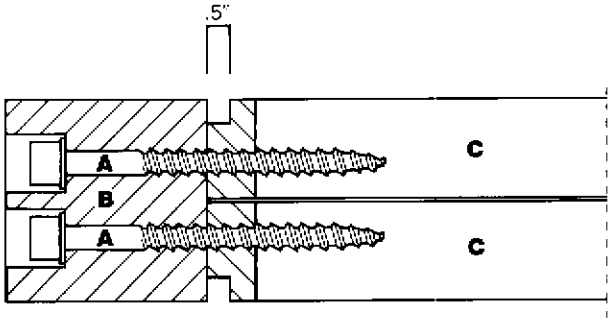


Detail 4

A .3125" socket head cap screw and .3125 " washer, countersunk at least .25" from the surface of the sign post.

B Solid or glue laminated post.

C Sign panel with 2" x 1.25" routed endstrip creating a .5" reveal.



Detail 5

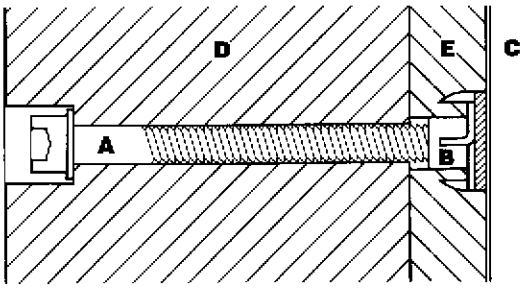
A .375" socket head cap screws and .375" washer, countersunk at least .25" from the surface of the sign post.

B .375" 4-prong straight barrel T-nut, countersunk and back-filled with Bondo or approved equal, flush to the front of the panel.

C Retro-reflective sheeting, applied after insertion of the hardware to the sign panel.

D Solid or glue laminated post.

E HDO sign panel.



Detail 6

A .375" socket head cap screw and .375" washer, countersunk flush to the front of the sign panel.

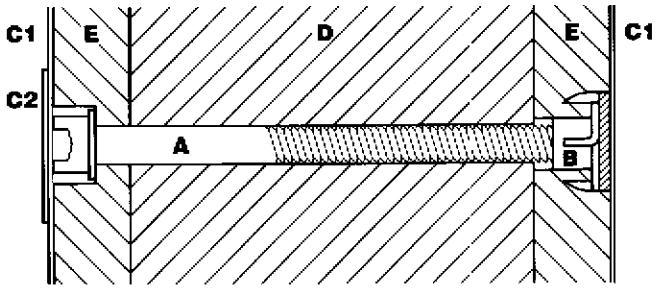
B .375" 4-prong straight barrel T-nut, countersunk and back-filled with Bondo or approved equal, flush to the front of the panel.

C1 Retro-reflective sheeting, applied after insertion of the hardware to the sign panel.

C2 Retro-reflective circular patch matching panel sign face.

D Solid or glue laminated post.

E HDO sign panel.



Detail 7

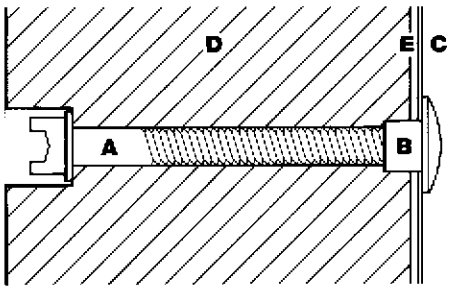
A .375" socket head cap screw and .375" washer, countersunk at least .25" from the surface of the sign face.

B .375" metal or plastic capped nut.

C Retro-reflective sheeting.

D Solid or glue laminated post.

E Aluminum sign panel.



Detail 8

A .25" stainless steel hex head cap screw with .25" flat stainless steel and .25" PVC washer.

B .25" 4-prong straight barrel T-nut, countersunk and back-filled with Bondo or approved equal, flush to the front of the panel.

C 3" x 2.6875" x 2.6875" aluminum 6061-T6 "Z" bar, .25" thick.

D .375" socket head cap screw and .375" washer, countersunk at least .25" from the surface of the sign post.

E .375" zinc-plated hex nut with .375" zinc-plated flat washer.

F Glue laminated or solid post.

G HDO sign panel.

H Retro-reflective sheeting, applied after insertion of the hardware to the sign panel.